the OIL AND GAS JOURNAL
MARCH 3, 1958

Gas Chromatography

Here's how plant efficiency can be increased at low cost . . .

p. 88

An expert analyzes **The New Venezuela**

. . . meet Perez de la Cova, the new oil minister

pp. 66-68

Labor Sets '58 Bargaining Goals p. 63

Rising Octanes Will Be Forced Still Higher

p. 76

THE FIRST HUNDRED YEARS

In just a few months, the petroleum industry will note the beginning of its hundredth year from the date of the Drake discovery. From this modest start, the oil business has grown into an empire of energy . . . one of the vital sources of power for the needs of man.

Reviewing the past and previewing the future . . . one of the most important factors contributing to oil's commanding position is research – the continuous investigation to do things better. Halliburton will continue to devote a substantial share of its resources for "the better way."

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
March 3, 1958

It's a good bet the majors will be asked to cut imports:

That will be the solution to handling the spate of requests for quotas made by smaller refiners.

The majors know the wind is blowing that way.

Their key officials have been called in for talks by Imports Boss Carson. He reportedly told them informally that with the flood of new applicants the big importers would be asked to tighten their belts.

No new quota figures were given. The talks were only preliminary and the new policy is not yet firm.

But Carson is determined to keep within the present limits for imports, and the majors seemed destined to take most of the cuts.

Don't count on an industry bolt from the National Petroleum Council, due to be shorn soon of its oil-man chairman.

Meetings have been going on quietly among oil and government leaders.

Some progress is being made toward a working arrangement for oil men to stay on the council even though it presumably will be dominated by bureaucrats.

Calmer heads feel interests of both the industry and Government will be served by cooperation. Oil men still can make their influence felt. Government can have the benefit of expert advice on petroleum problems.

The supply of engineers is heading upward.

An all-time high of 257,777 students enrolled in the engineering departments of accredited colleges last fall.

This is a 5.5 per cent jump over the previous peak in '47.

Male engineering students now make up 12.8 per cent of all male students enrolled for degrees.

Two other developments: Engineers seeking the master's degree increased 7.6 per cent over last year. Candidates for doctorates took a 22.9 per cent jump.

Here's a development to consider: Demand for oil products is tied closer to the business cycle than in the past.

Oil economists now are pointing out this trend in trying to explain what happened to demand. Formerly they assumed people heated homes and drove cars about the same even in tight times. But now they say this is the situation:

...Residual fuel, always tied closely to industrial production levels, felt any recession, still does.

...Distillates have become more vulnerable; 40 per cent of their demand is now affected by business cycles. This is due to dieselization of railways and trucks. The weather and inroads of other fuels also can affect the remainder.

...Gasoline demand is also hurt by cyclical changes. An estimated 37 per cent of its demand now is tied to business conditions, only 63 per cent due to passenger auto use.

The profits squeeze is getting tighter as 1958 starts winding up the first quarter.

Costs aren't dropping. Products prices aren't improving. Cutbacks in production and refinery runs only add to inefficiency and make the cost-price pinch tighter.

This is the tune being sung in profits statements for 1957 now being released by oil companies. These annual reports give this explanation for drop in profits:

Increase in nonproductive exploration costs and loss in net income from refining due to deterioration in product prices.

The early annual reports include these:

	Profits		Per Share Income		Per Cent Change In
	1957	1956	1957	1956	Net Profits
	(thousand $)				
Anderson-Prichard	5,200	5,900	2.93	3.41	Down 11.9
Ashland Oil & Ref.	15,544	14,233	2.41	2.26	Up 9.2
Atlantic Refining	35,670	47,210	3.82	5.11	Down 24.4
Continental	46,700	51,817	2.38	2.65	Down 9.9
Hudson's Bay	3,100	2,400	0.17	0.13	Up 29.2
International Pet.	41,100	38,200	2.83	2.63	Up 7.6
Imperial	72,000	69,098	2.29	2.20	Up 4.2
Plymouth	6,026	7,958	2.40	3.22	Down 24.3
Shell	135,000	135,848	4.46	4.49	Down 0.6
Socony	220,000	249,503	4.62	5.70	Down 11.8
Standard (Ohio)	23,920	26,591	4.79	5.35	Down 10.0
Standard (NJ)	800,000	808,534	4.05	4.11	Down 1.1
Sun	47,492	56,160	4.17	5.22	Down 15.4
Husky*	1,414	1,020	0.41	0.28	Up 38.6
Kerr-McGee*	2,536	2,713	0.91	1.22	Down 6.5

* 6 months of fiscal year 1957-58.

There's good omen for oil in transfer of Carlos Perez de la Cova from Venezuelan embassy in Washington to Caracas as minister of mines and hydrocarbons under new junta.

Perez de la Cova is an American-trained engineer who knows oil from the fields on up. Also he's well known in the industry and well liked (p. 68).

Exploration news is back in the headlines:

...Paradox basin may take a big jump far to the northwest in Utah. Continental is setting pipe at two reported producers in San Juan County. Both are extremely tight holes in virgin territory (p. 77).

...French are excited about a wildcat only 28 miles from Paris. The well flowed 50 bbl. of oil on 75-minute test. It's best news since Parentis (p. 85).

...In the Algerian Sahara, Phillips and Cities Service have won concessions along with five other British, Dutch and French firms. The seven awards covered 28,600 sq. km. and call for spending $18 million in a hunt for oil (p. 84).

...In Lake Maracaibo, San Jacinto group has two more flush wells in reserve block V-575, fast growing into one of best spots in the lake. Latest wells have combined flow of 9,024 bbl. daily on tests.

This area is rivaling a new golden lane in midlake for production potential (p. 66).

Alberta grabbed off the exploration spotlight for February (p. 212).

Discovery of Devonian gas at Panther River in the Rockies and more Beaverhill Lake-Devonian oil in the famed Virginia Hills region were significant.

They topped successes south of the border that stretched from California to eastern Kentucky.

Don't sell the Denver basin short. Look for drilling really to perk up there between now and 1960.

It's still a fertile hunting ground for the aggressive independent. Consider the facts: Places to drill are plentiful. Pipelines are available. Oil is high gravity. Depths are shallow and drilling cheap.

Also a wave of lease expirations is about to engulf the area (p. 201).

Drilling off the Texas coast may get a shot in the arm in the closing months of the year.

Here's why: State leases covering many thousands of acres are scheduled to expire in December. Most of the acreage, held since December 1953, is still untested. And farmouts at present are going begging.

The turbodrill had bit troubles in English tests.

An experiment to compare efficiency of French turbodrill and conventional bit showed:

...Turbodrill averaged 45 to 50 ft. per hour against 24 to 25 ft. by conventional rotary.

...More bits per footage drilled were used by turbo.
...Frequent bit changes actually increased over-all drilling time for the turbodrill (p. 133).

World's first quadruple completion is the claim for a Magnolia gas well in Hidalgo County, Texas.

Magnolia has gas production from three parallel 2 1/16-in. tubing strings and from the 7⅝-in. casing annulus. The trick was turned like this: Usual down-hole arrangement was made for a triple. Fourth zone was added simply by perforating a zone above the top-most packer.

Pipeline companies can count on heavy relocation costs brought on by the federal highway-building program.

Transco reports it spent $100,000 last year and already has laid out $750,000 this year in relocating, lowering, and casing lines.

Companies are reimbursed in most cases for material and labor costs. But they never recover revenue lost.

Refiners will get first look at new processes for alkylation of aromatics and isomerizing butane during WPRA meeting at San Antonio later this month.

They're called Alkar and Butamer.

Both are arousing considerable interest.

Alkar is designed to make ethyl benzene, cumene, and many other alkylated aromatics. It can efficiently process catalytic-cracker offgas streams without concentrating ethylene in the offgas.

Butamer isomerizes normal butane to isobutane through a clean reaction with little loss to byproducts.

Refiners trying to second guess compression ratios in 1959 should keep an eye on the West Coast.

Detroit certainly is. This region has become the depressed area for octane ratings and has put a ceiling on new car requirements.

Tidewater broke loose from the field a few weeks ago with 100-plus premium octane. The auto industry pricked up its ears.

This is a tipoff for new interest in 10½ to 1 ratios for 1959. Some designers may go higher. If Tidewater gets the expected response to its move, look for West Coast octanes to go higher too.

OCAW's wage goals for oil have been drawn up:

...Pay increases equal to 2.26 per cent rise in cost of living plus a 3.5 per cent annual raise. It's about a 6 per cent package.

...Longer contracts and greater protection from layoff (p. 63).

Good Things Come in Pairs . . .

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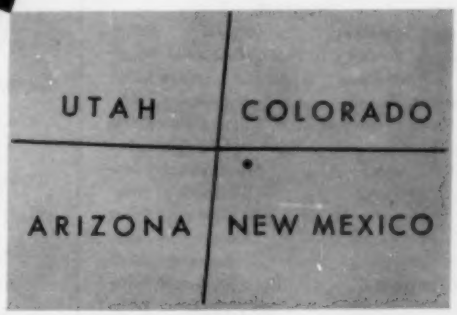

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IN THE NEWS

General Interest:

OCAW Asking More Pay and Fewer Layoffs for 1958 ... 63
Domestic Producers to Fight for Strong Import Controls ... 65
Venezuelan Politics Good, But Oversupply of Oil Hurts ... 66
Diplomat Named by Venezuelan Junta to Head Oil Agency ... 68
Companies Lose Half Million Fast in California Deal ... 70
First Asphalt-Carrying Ship Will Operate This Month ... 78
Indiana Standard Promotes Prior and Swearingen ... 219

Production and Drilling:

Water-Flood Report on Citronelle Due Soon ... 72
Small Flood Raises Recovery Hopes in Denver Basin ... 74
Refiners Cut Nominations for Alberta Production ... 80
Magnolia Makes Quadruple Completion at Texas Gas Well ... 81
Subsidence in Wilmington Field Blamed on Oil Production ... 82

Pipelining:

Harris Gas Bill Vote Coming Soon; Ike Supporting It ... 65
FPC Member Sees Good U. S. Market for Canadian Gas ... 70
Pipeline Briefs ... 72
Nation's Pipeline Network Shows Impressive Growth ... 74
Suit Claims Pipeline Tariff Based on Valuation Is Illegal ... 78

Processing:

Building Denver Refinery Unit from Model Saves Time ... 64
UOP Sale Approved, But 10 Per Cent Commission Denied ... 71
Industry Rivalry, Detroit Pressure Force Octanes Higher ... 76
Lube-Oil Demand Is Dropping Along with FRB Index ... 78
Cold Weather Cuts Products by Biggest Amount in 13 Years ... 80
Processing Briefs ... 80
Transceivers Permit Esso Computers to Do Double Duty ... 82

International:

Sahara Concessions Awarded to Non-French Firms ... 84
French Firm Makes Important Discovery Near Paris ... 85
Middle East Record Production Raises Free-World Total ... 86
Committee Urges More Drilling in Western Europe ... 87

Exploration:

Two Conoco Wildcats in Paradox Have Industry Buzzing ... 77
West Bijou Discovery Wakes Sleepy Denver Basin ... 201
Tips on How to Freshen Up Your Old Well Logs ... 202
Devonian Is New Target in Canadian Rockies ... 212

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TECHNOLOGY—OPERATION

Refining-Processing

How Gasoline Plants Are Using Gas Chromatography 88

By A. J. Miller

Phillips discovered it could keep tab practically up to the minute on plant-recovery efficiency and observe the effects of even small changes in operating variables, such as weather temperatures.

Engine Wear Measured While You Wait 91

Where Are Petrochemicals Headed? 95

By W. E. Kuhn

Petrochemical production is scheduled to increase more than 100 per cent between now and 1965. About 50 per cent of the raw materials come from refinery operations and the rest come from natural gas and LPG. Supplies from these sources should be adequate during this period.

How to Minimize Corrosion in Amine Plants 100

By J. S. Connors

The aqueous-amine process for removing acid from natural gas can be made practical with proper design of an amine treater. And by this proper design, carbon-steel equipment can be used and corrosion will be minimized at the same time.

Solids Waste Disposal in the Refinery 125

By S. O. Brady

Here is an approach to the over-all problem with some possible solutions. The author suggests that an entirely new approach is needed in order to find an answer before "our clay pile crowds us out of the refinery."

On The Job . . . In The Plants 139

A double layer of 85 per cent magnesia insulation gives improved temperature control, increased heat savings, and added fire protection to natural-gasoline plant—Pure Oil Co. refinery has found two ways to distribute lube oil.

COSTimating 167

Pipelining

El Paso's New Panoma Gas Compressor Station 92

By Barry Hunsaker

Recent advances in the design and construction of compressor stations are incorporated into this new plant near McLean, Tex. Plant layout and operating efficiency have been improved.

Pipeline Construction Report 171

Drilling-Production

Chemical Compatibility Problems in Water-Injection Systems 113

By G. J. Samuelson and B. H. Moore

Wider applications of specialized treating techniques and greater use of additives are indicated for water-flooding work. Each treatment should be tailormade with careful attention to techniques and kind and amount of additives. These techniques have been proved in field use and continuing research will clarify the areas of uncertainty which now exist.

Comparison: Turbodrill and Conventional Bit 133

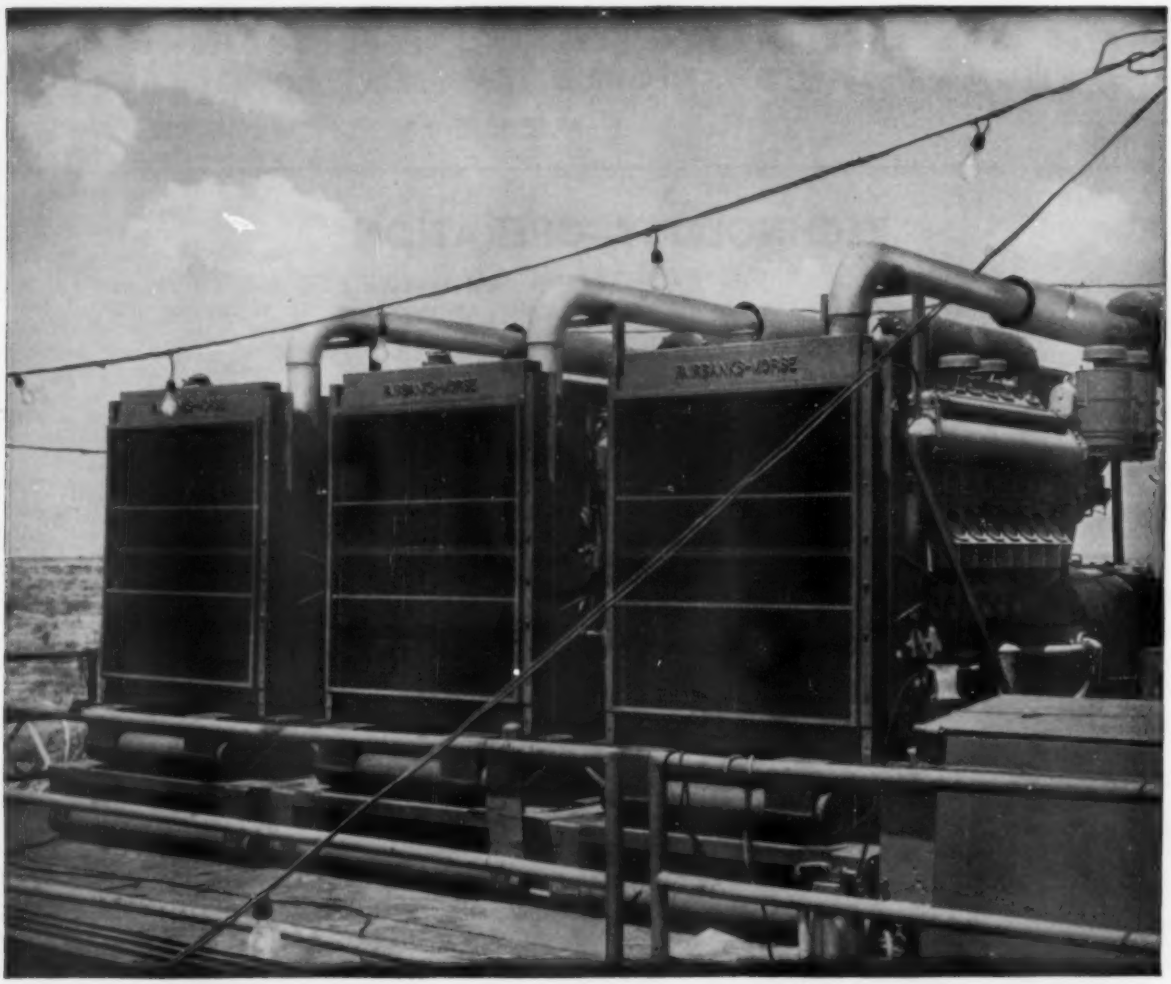
By E. Lawson Lomax

Recent British tests show that turbodrills average 45 to 50 ft. per hour compared to 24 to 25 ft. by conventional rotary. Turbodrills use more bits per footage drilled. In some cases more frequent bit changes may actually increase drilling time.

Modern Drilling 165

DEPARTMENTS

They Say	44	COSTimating	167	Deaths in the Industry	222
Calendar of Events	50	Pipeline Construction Report	171	Statistical Summary	224
Journally Speaking	57	Drilling Contractors	185	Drilling Statistics	225
Editorial	59	New Equipment	190	Supply Statistics	226
Watching Washington	71	Trade Literature	194	Refining Statistics	227
International News	84	Equipment Men in the News	195	Markets	228
On the Job . . . In the Plants	139	Exploration Highlights	201	Classified Advertising	229
Modern Drilling	165	Personals	219	Advertising Index	233



The 38-F-90 is a drilling engine

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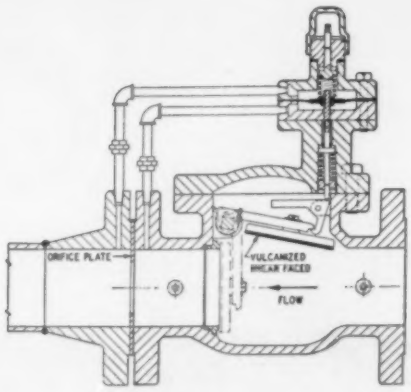
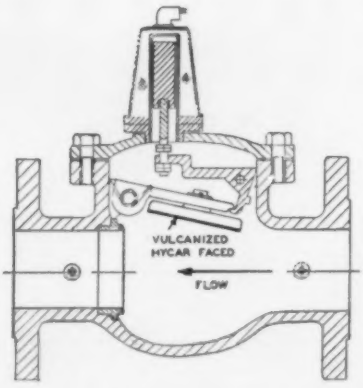
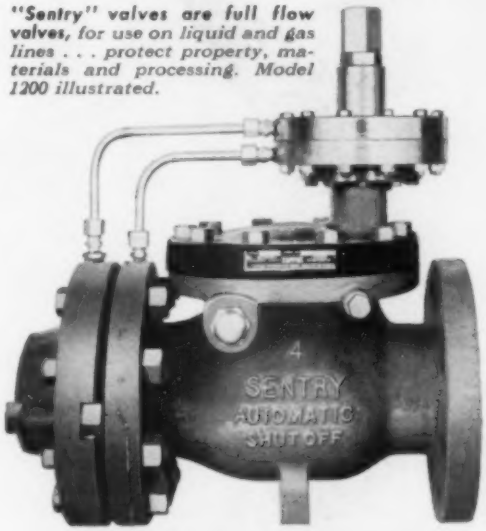


Model 1200. "Sentry" **excess flow valve** *automatically and instantaneously shuts off when the rate of flow in the line exceeds a predetermined rate.*

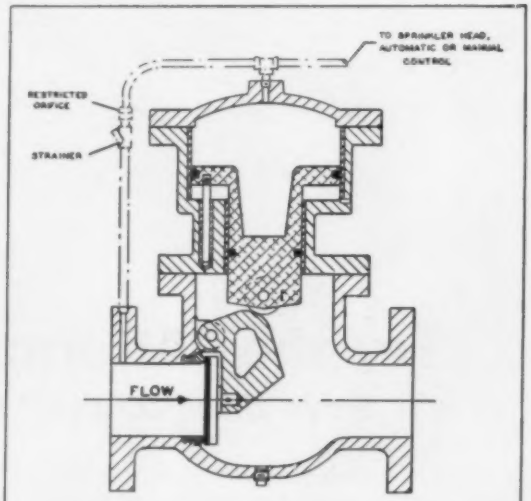


Models 1700 and 1800 "Sentry" **solenoid shut-off valves** *operate by remote electrical control automatically and instantaneously. In Model 1700, solenoid is energized, in Model 1800 solenoid is de-energized to maintain flow.*

"Sentry" valves are full flow valves, *for use on liquid and gas lines . . . protect property, materials and processing. Model 1200 illustrated.*



Other types "Sentry" Valves: high-pressure and low-pressure and over temperature shut-off valves available.



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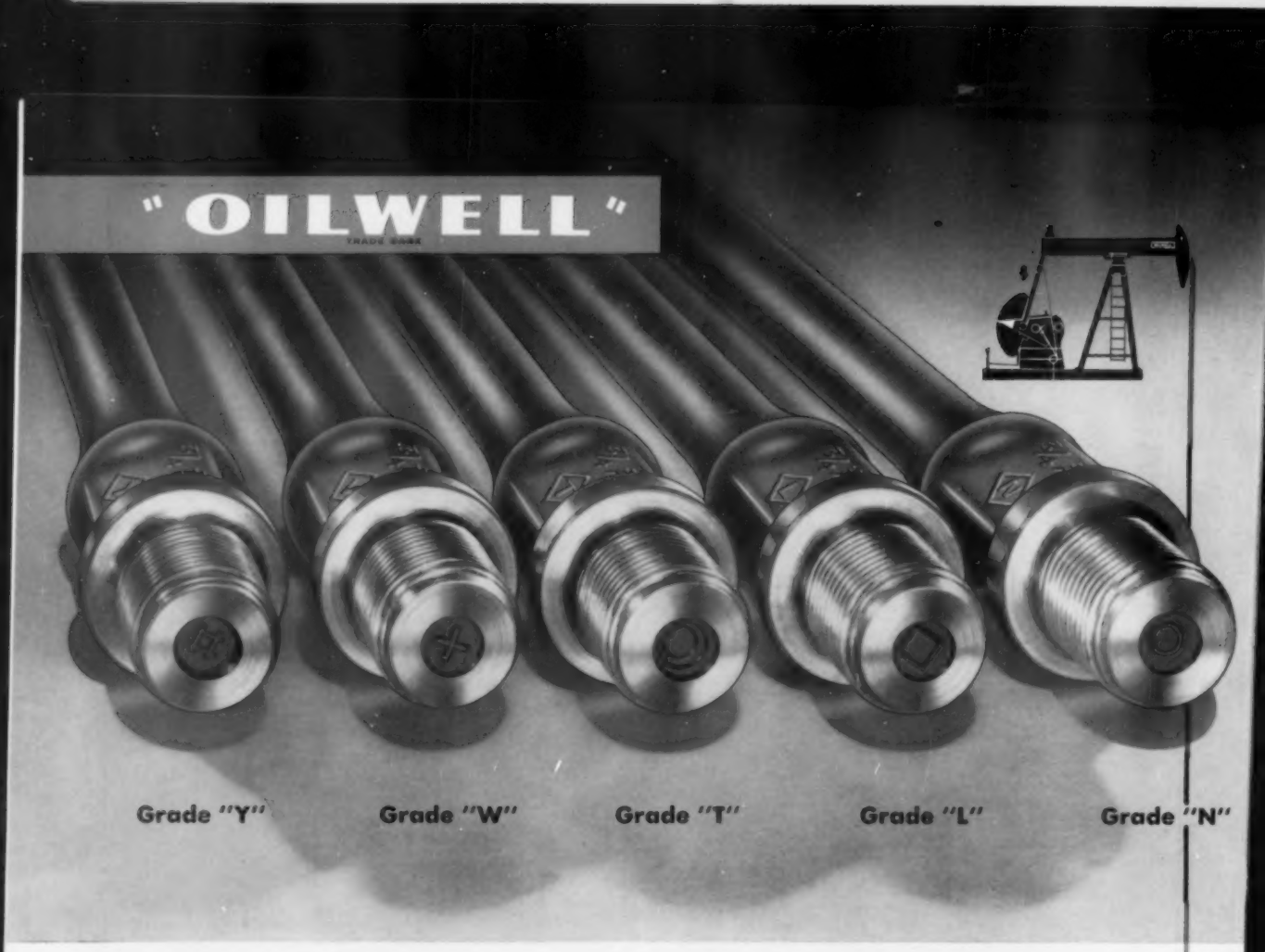

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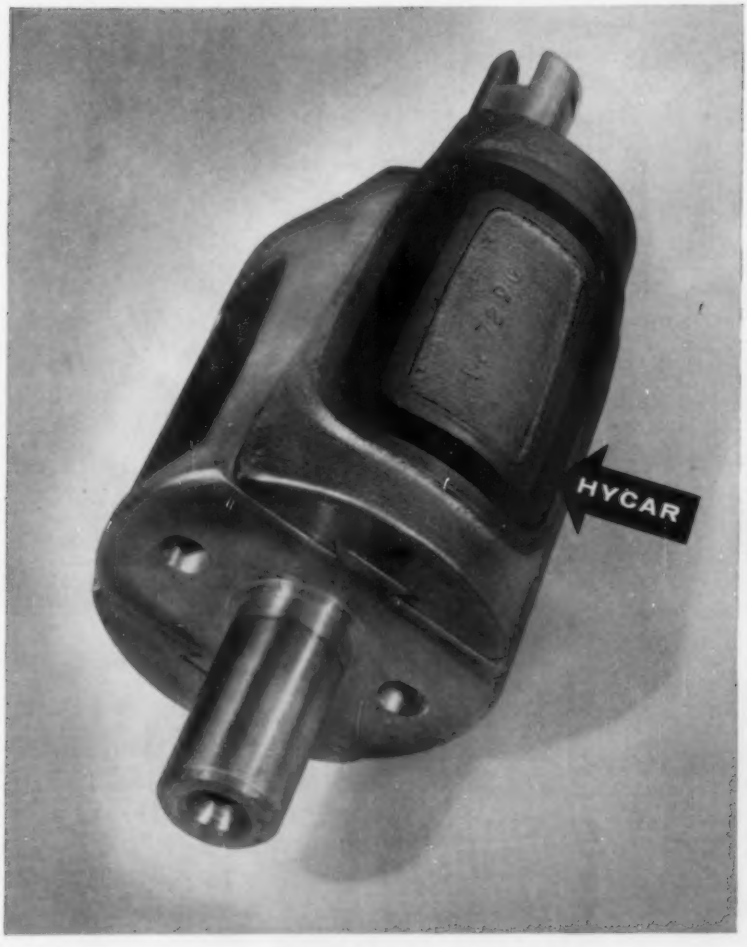
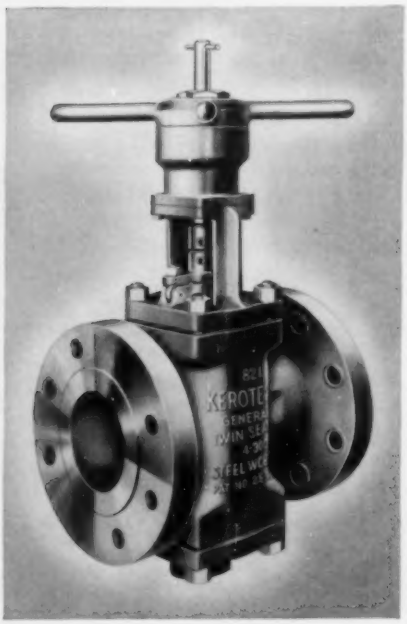


This Kerotest General Twin-Seal plug-type valve made by Kerotest Manufacturing Company, Pittsburgh, has two "slips" as seating surfaces with Hycar bonded to them. They are retracted when valve is opened, expanded when valve is closed to provide positive, vapor-tight seal. Hycar face slips are made and bonded by Castle Rubber Company of East Butler, Pa. B.F.Goodrich Chemical Company supplies the Hycar rubber material only.



Hycar makes valves seal vapor-tight

CARRYING and controlling hard-to-handle gases and chemicals calls for valves that seat securely. This new plug valve uses Hycar rings bonded to its "slips" to assure a vapor-tight shutoff.

Hycar nitrile rubber is ideal in applications like this. Its outstanding resilience means that it can withstand repeated and severe mechanical deformation. Since it lives with hydrocarbons that would destroy other types of rubber, it can be used for natural gas, distillate, and sweet and sour crude oil. And it will stay flexible under temperature variations.

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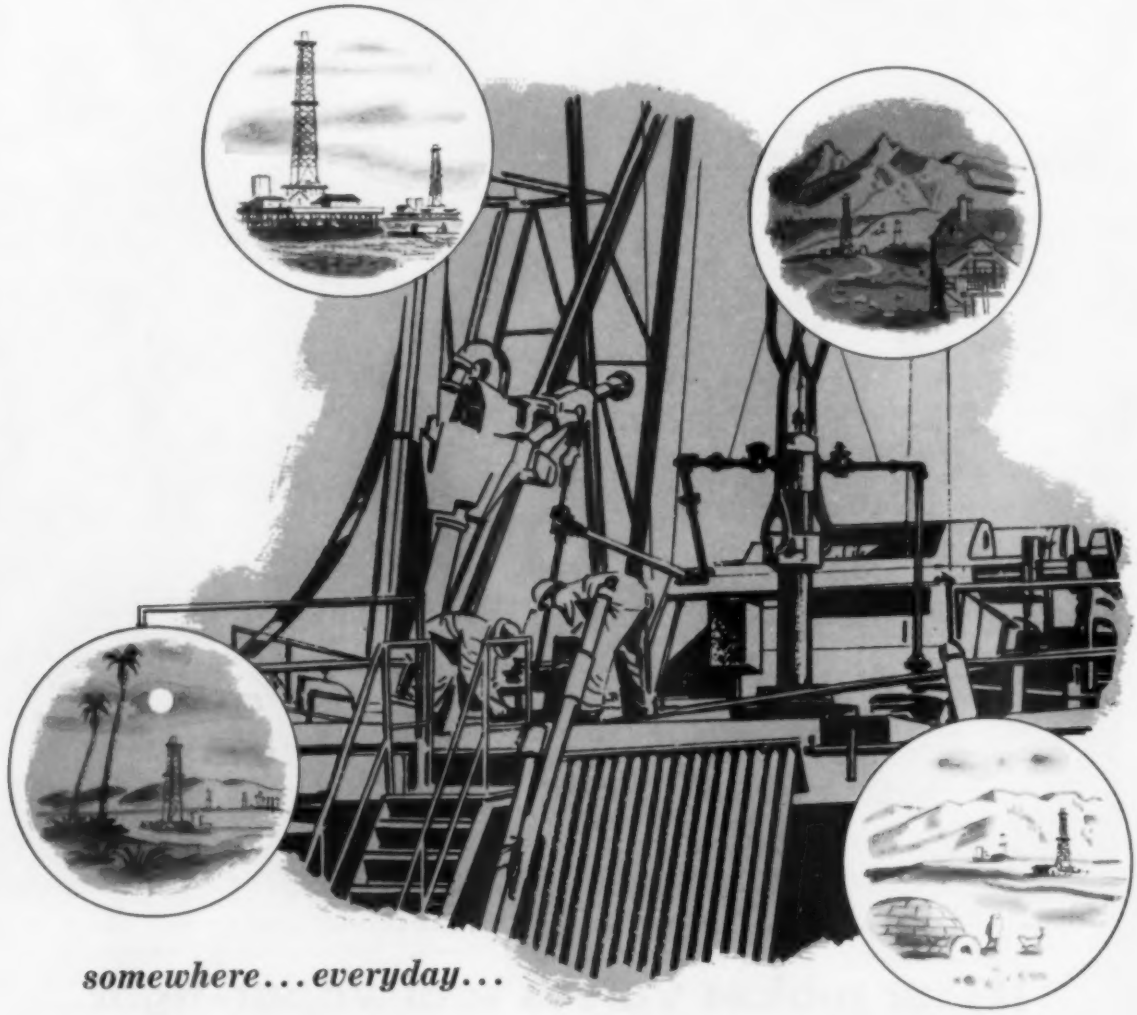


somewhere . . . everyday . . .

Halliburton is called upon to solve these frequent problems: • Water or gas encroachment in oil producing zones • Repair of casing leaks • Isolation of producing zone prior to perforation for production • Correction of conditions such as channeling or insufficient fill-up on primary cementing • Plugging off crevices and cavities that cause lost circulation • Abandonment of depleted producing zones to prevent migration of fluids and reduce possibility of contaminating other zones or other wells.

Halliburton's cementing specialists precisely squeeze a pre-selected, tailored cement slurry into an exposed formation or casing perforations to one or more down-hole trouble spots.

No better solution to your squeeze cementing problems . . . at any price.

Call HALLIBURTON!

HALLIBURTON

OIL WELL CEMENTING COMPANY

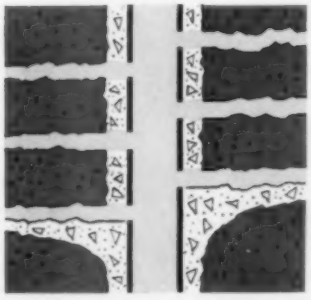
DUNCAN, OKLAHOMA

SQUEEZE CEMENTING IS MORE EFFICIENT AND EFFECTIVE WITH THESE HALLIBURTON PRODUCTS

HYDRAULIC RETRIEVABLE CEMENTER

HRC—HYDRAULIC RETRIEVABLE CEMENTER

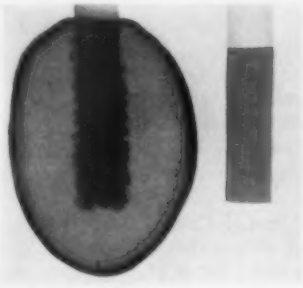
Designed to perform efficiently under the highest pressures and most difficult operating conditions encountered in squeeze cementing. Simply operated, easily set by hydraulic pressure. Tubing can be pressure tested up to 10,000 p.s.i. as packer is set. The HRC can be set, released and reset as many times as desired without coming out of hole.



HALLIBURTON'S DOC (Diesel Oil Cement)

Uses water in the formation to produce a set cement of high density, high compressive strength and very low permeability. Widely used in squeeze job operations to aid in shutting off water in oil wells.

Since DOC is composed only of cement, diesel oil and Halliburton's efficient dispersant DOC-3, it will never set until contacted by water. After the initial contact with water, which thickens the slurry, the unthickened DOC in the pipe is reversed out with ease. This desirable feature provides effective water shut-off with relatively small volume of this low fluid loss mixture.



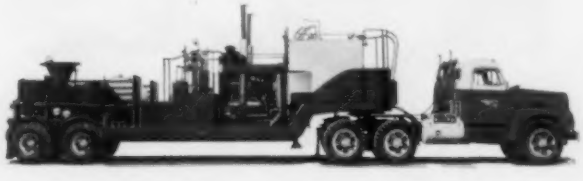
RESIN-CEMENT

A blend of resins, water and portland cement with excellent "squeezing" characteristics. Successfully used for open hole bottom plugs, squeezing through perforations, setting around casing shoe or opposite water zones and other remedial work in oil or gas wells where ordinary cementing materials fail. The fluid phase that is squeezed from the Resin-Cement slurry penetrates into the formation and sets up in a firm, hard mass which gives a very effective seal that is resistant to oil, mud, corrosive waters and gases.

DM-DC SQUEEZE PACKER

DM-DC SQUEEZE PACKER

Halliburton DM-DC Drillable Squeeze Packers—specially designed for squeeze cementing. Dependable and easy to set on drill pipe, tubing or electric wire line—provide a positive fluid "shut-off" from either direction, regardless of depth and pressure. May become a Bridge Plug when a Sealing Plug or Ball is dropped or pumped in place after the Packer is set.



CEMENTING SERVICES

284 SERVICE CENTERS—JUST MINUTES AWAY FROM YOUR WELL

THROUGH CONDUIT..

all the way with

W-K-M *GATE VALVES*

Your well completion and production problems are materially reduced with W-K-M® Through-Conduit Gate Valves on your christmas trees. You get smooth non-turbulent fluid flow from tubing to gathering line with positive wellhead control.

Gates in W-K-M Valves have openings that are flush with the body passages with no place for sediments or paraffin to lodge or for corrosion to start.

The bore of W-K-M Through-Conduit Gate Valves has the same ID as the tubing it's used with so that it is possible to swab, caliper, run plugs, and perform many types of work-over operations right through the valve without disassembling the tree.

1. Parallel Expanding Gates for CONTROLLED FORCE SEATING
2. Teflon* inserts provide positive DOUBLE-TIGHT SEAL†
3. Two Thrust Roller Bearings
4. Enclosed Packing Gland
5. Pressure Seal Bonnet
6. Gates and Seats replaceable while valve is on tree

For full technical information concerning W-K-M Through-Conduit Gate Valves, write Dept. A-303 for catalog 200.

W-K-M

DIVISION OF ACF INDUSTRIES INCORPORATED

PLANT: MISSOURI CITY, TEXAS
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

W-K-M IS A REGISTERED TRADEMARK OF ACF INDUSTRIES, INCORPORATED
*DUPONT'S TETRAFLUOROETHYLENE RESIN. †PAT. PENDING.
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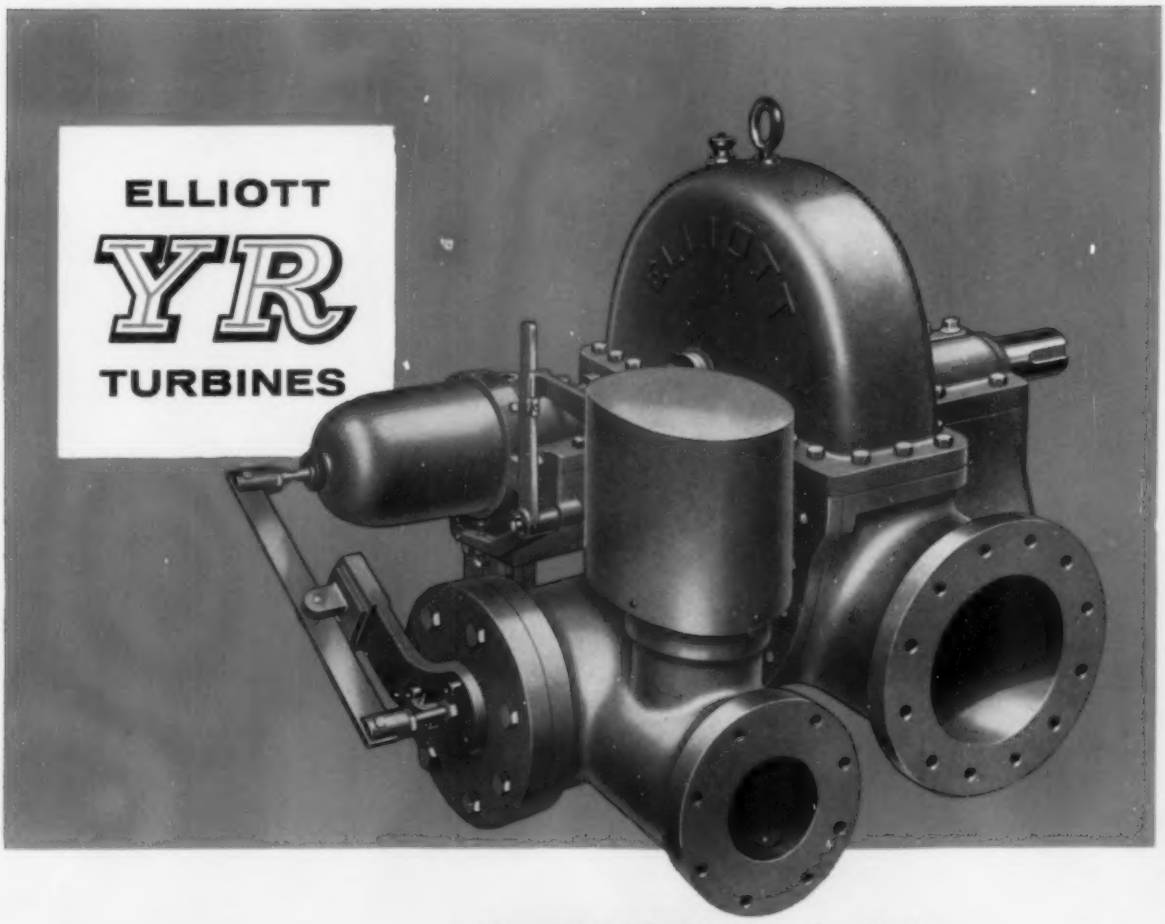
5725

MANUFACTURERS OF W-K-M GATE VALVES · ACF LUBRICATED PLUG VALVES · KEY-KAST ALLOY STEEL PIPING FITTINGS · KEY RETURN BENDS AND FITTINGS

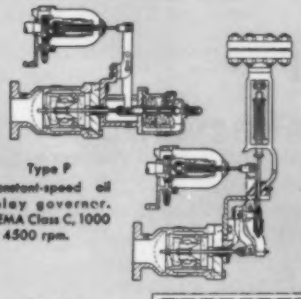
ELLIOTT

YR

TURBINES



YOUR CHOICE OF DESIGN MODIFICATIONS TO MATCH YOUR SPECIFIC APPLICATION REQUIREMENTS



Type P
Constant-speed oil relay governor. NEMA Class C, 1000 to 4500 rpm.

Type P
Built-in constant or differential pressure pump governor—to 4500 rpm.

Type O
Variable-speed oil orifice governor. NEMA Class A, 800 to 10,000 rpm.

Other modifications include electric and pneumatic remote trip, high back-pressure trip, electric and pneumatic speed changer, low oil pressure trip, special shaft extensions, and various accessories.

simplified design includes reliable governing system

The Elliott-engineered, direct-acting governing system with over-speed trip and valve (NEMA Class A) positively insures smooth uniform speed 24-hours-a-day, day-after-day, year-after-year. The horizontal, fly-ball-type, speed-sensitive element is effectively weather-proofed by an aluminum enclosure . . . mounted on the end of the turbine shaft and directly connected to the steam admission valve by a sturdy linkage. Mica-impregnated packing and a flexible, non-aging Neoprene grommet insure an effective steam seal over long operating periods.

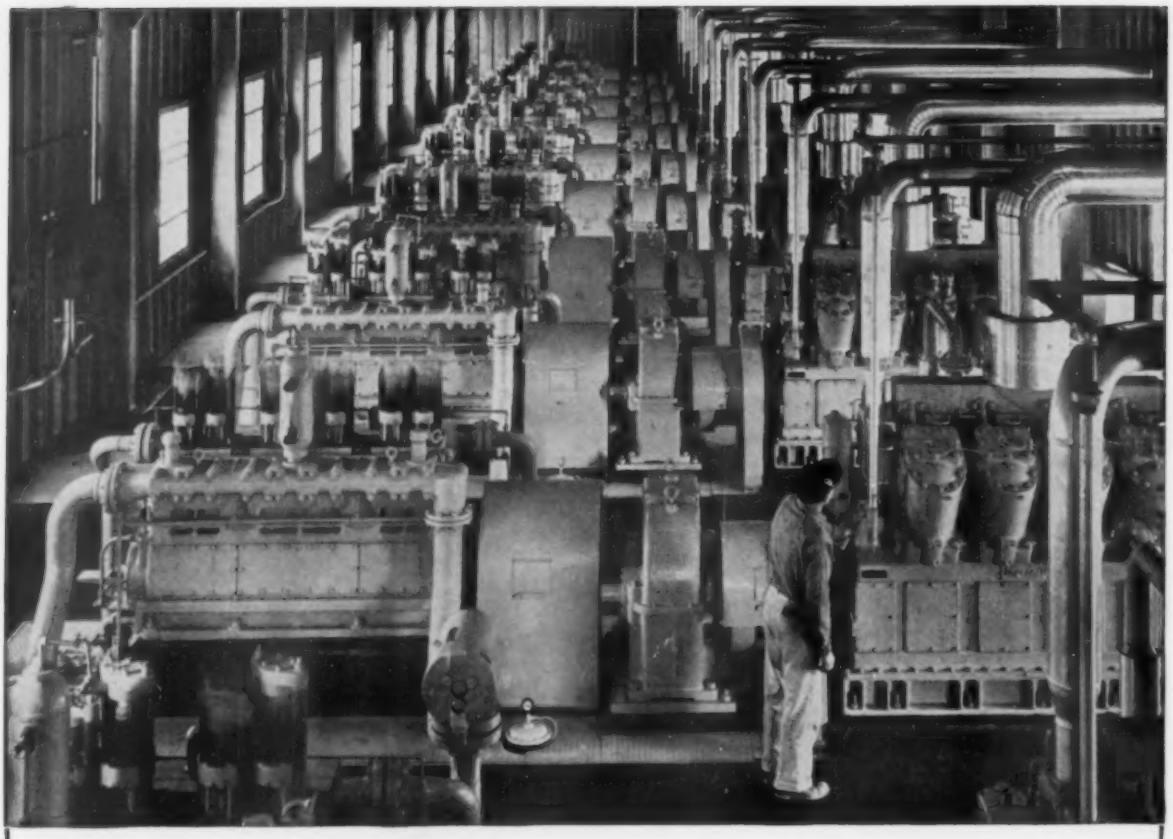
Other design benefits of Elliott single-stage turbines are easy inspection . . . simple replacement of wearing parts . . . and interchangeable components from one turbine frame to another. And always near you is your Elliott field engineer. For full details write Elliott Company, Steam Turbine Department, Jeannette, Pa. Ask for Bulletin H-22B.

day-in/day-out

ELLIOTT Company

H8-1

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS



FIELD REPORT

FLOOD: North Ward-Estes Unit

PUMPS: 10 Aldrich Septuplex

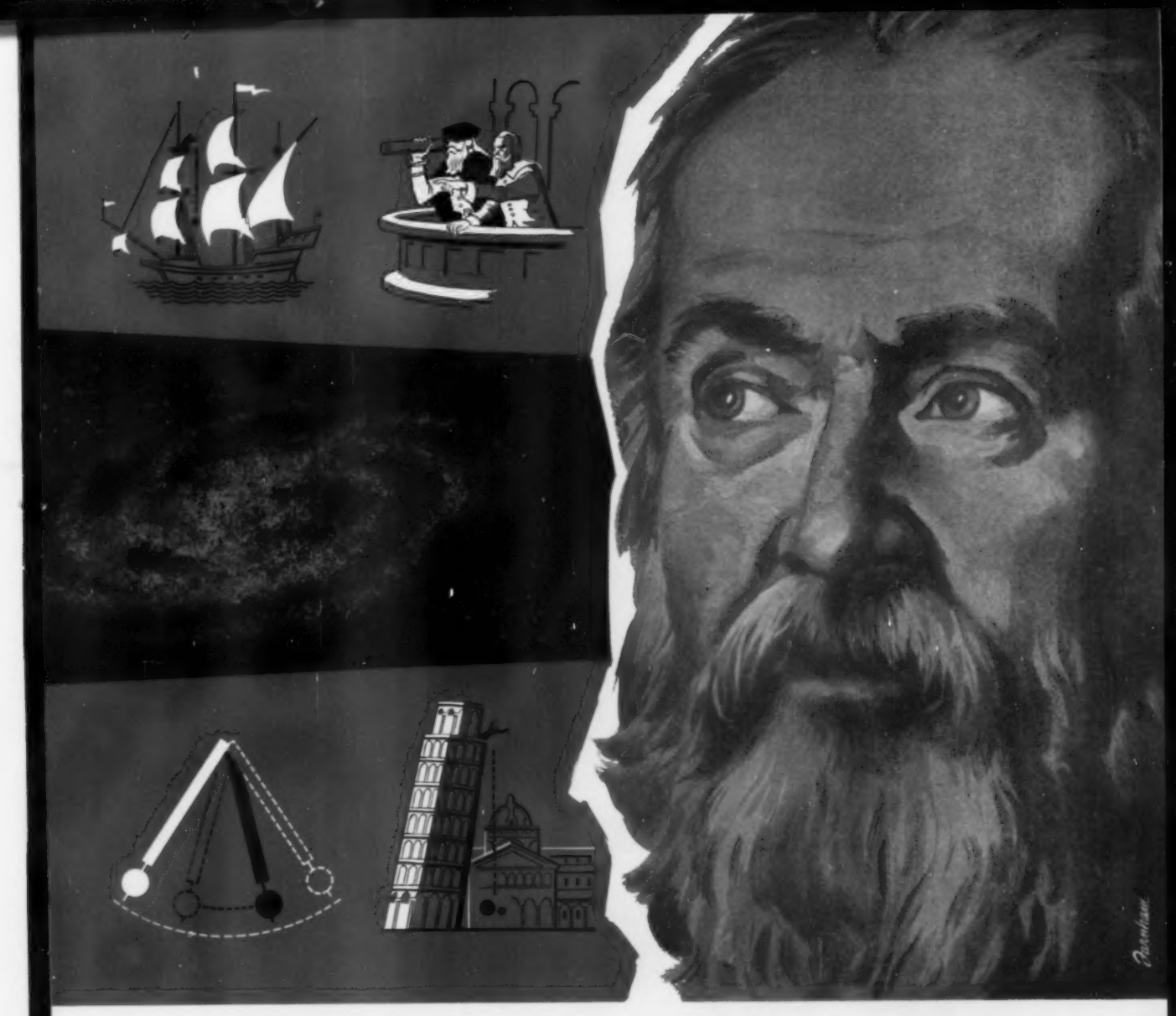
FLOODING STARTED: December 1954

EXPERIENCE TO DATE:

Pumps operate constantly — 168 hours per week. There have been no breakdowns ... customer reports installation highly satisfactory ... "Maintenance actually has been less than we expected."

Field parts stock available in Carmi, Ill., Charleston, W. Va., Houston, Los Angeles, Odessa and Tulsa. For further information, write the Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH



Scientific Coordination. Galileo coordinated the knowledge of his day to produce thought changing data for modern science. General Geophysical has coordinated its manufacturing, laboratory, and field exploration facilities to produce *accurate data* for its clients' decisions. General's engineers design and build reliable recording equipment that is easily serviced in the field. The laboratory tests, *then retests* each unit for precision performance. General's field crews are fully informed personnel, trained to proficiently operate and maintain the equipment they use. With General's coordinated geophysical services on the job *you know* that your reference data are exactingly correct.

General GEOPHYSICAL COMPANY

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General Geophysical Company de France (Sarl), 4 Square Rapp • Paris 7, France
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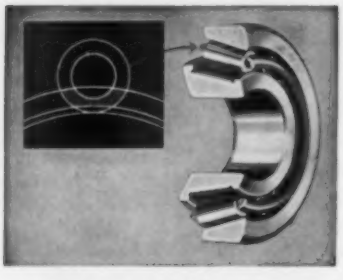
One of General's laboratory-field supervisors is always available for immediate on-the-site consultation with field crews.

WHEN YOUR CONTRACT IS WITH GENERAL, THE PERCENTAGE FOR SUCCESSFUL EXPLORATION IS IN YOUR FAVOR

Built to stand up . . . under 'round-the-clock pressure!



HIGHER FLANGE IMPROVES ROLLER ALIGNMENT

As shown by the gray area above, the higher flange provides a large two-zone contact area for the roller heads. This greatly reduces wear—practically eliminates "end play". Larger oil groove provides positive lubrication.

The flow of America's vital oil can't be regulated by a time clock! These bobbing pumps work around the clock, around the year—with virtually no attention whatever! Dependable Bower Roller Bearings are more than proving their ability to stand this back-breaking pace—doing it with a minimum of maintenance cost and down-time. That's because important Bower Spher-O-Honed design features, like the one shown at left, have reduced bearing failure to a rarity. Whatever test *you* put them to—tractors, machine tools, jet engines—you'll find that Bower Spher-O-Honed Bearings will last longer and operate more efficiently. Let a Bower engineer show you the many advanced design features and superior quality of the complete Bower line. There are tapered, straight and journal roller bearings for every field of transportation and industry.

BOWER ROLLER BEARING DIVISION
FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 14, MICHIGAN

BOWER ROLLER BEARINGS

THREE New International V-8's

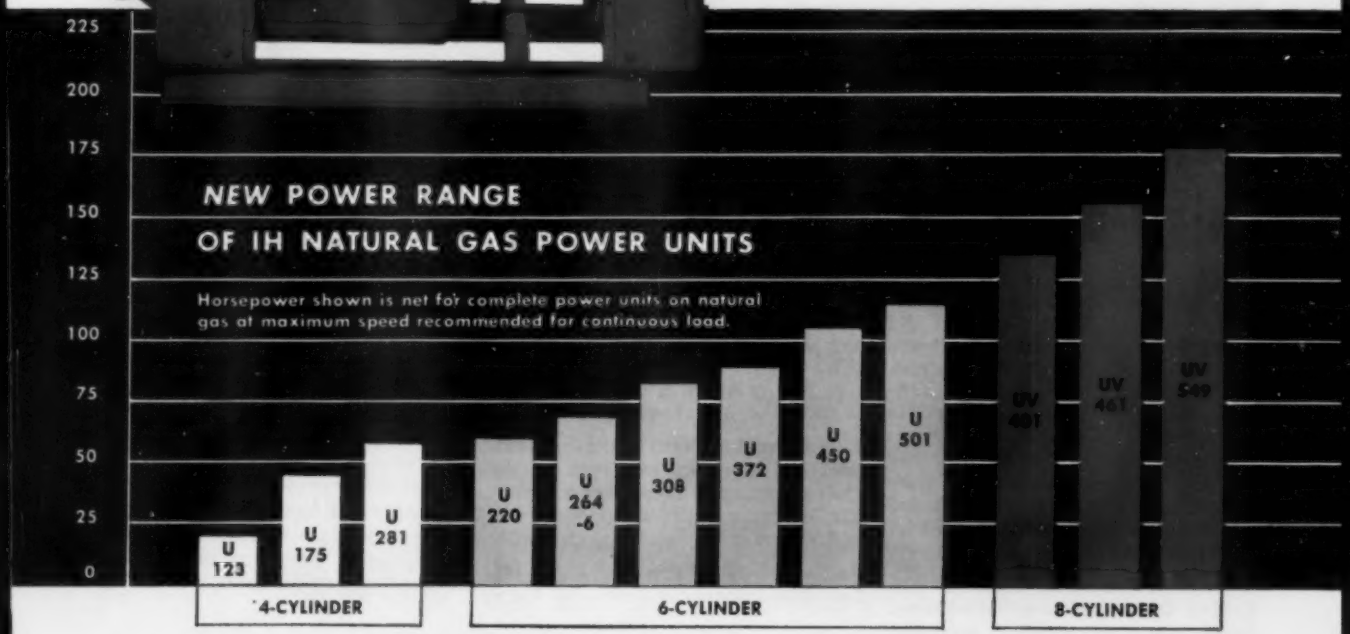
Now you have an even wider selection of economical International valve-in-head gas power for your oil field needs – three new power-packed, compact V-8's – the UV-549, UV-461, and the UV-401.

NEW V-8 UV-549 POWER UNIT. 178 net hp @ 2,600 rpm on natural gas, 200 hp on LPG, and 208 hp on gasoline. Stripped engine develops 257 hp on gasoline at 3,400 rpm.

These new V-8's increase the International carbureted line to 12 models that can be operated on the fuel of your choice—natural gas, LP gas, or gasoline. The bar chart below shows the power range of these 12 units when operating complete with radiator and fan on natural gas. Model numbers indicate piston displacement.

Standout features of the compact new V-8's that help you cut operating costs include: rigid, Y-shaped block; short-stroke, heavy-duty, camground aluminum pistons; big, smooth-running, counterbalanced, tocco-hardened, 5-bearing crankshaft; large-area, long-life, tri-metal, replaceable bearings; combination full-flow, bypass oil filter for long-life pressure lubrication; full-power, down-draft carburetion; oil cooler; and a 12-volt electrical system.

For the best in dependable power for your pumping, exploratory drilling and servicing rigs, it will pay you to investigate this new International line. You'll get power that outperforms with more in-built values. You'll get power that's backed by fast, efficient parts and service support available to customers throughout the world.



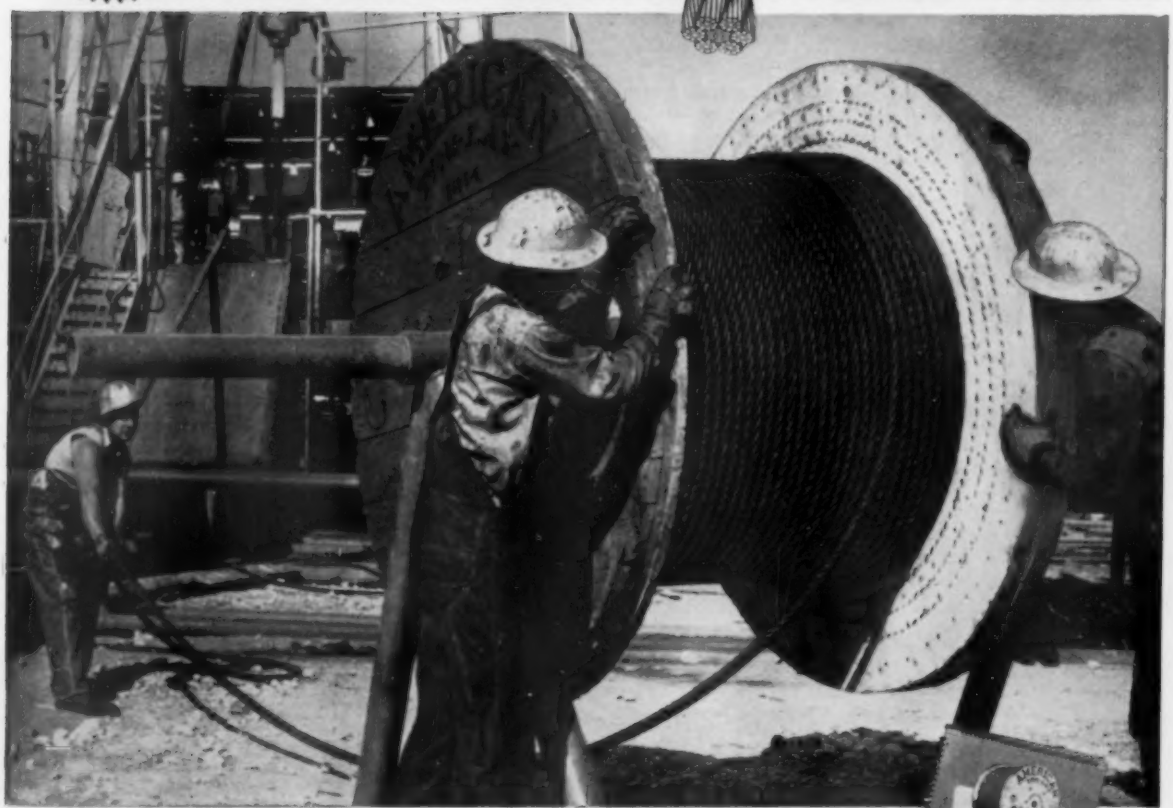
INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Power Units . . . Motor Trucks . . . Farm Tractors and Equipment.

ACCO
for Better Values

American Cable
TRU-LAY VHS WIRE ROPE
15% STRONGER



This 3-point control program will give you longer, safer rotary line life...

Stop guessing about how much service and safety you can expect from rotary drilling lines! Follow a definite line control program that is tailor-made to meet the specific requirements of your operation. More and more drillers are finding they can cut costs and get record breaking Ton-Mile performance from lines by following this simple 3-Point Control Program.

1. Use Only Tru-Lay VHS Lines. Made from a new grade of rope wire developed by ACCO's own process, VHS has 15% greater tensile strength than Improved Plow Steel. Also tougher and more wear resistant, VHS delivers more Ton-Mile service while resisting abrasion. And you can count on this great new rope to give you the highest safety factor available . . . a mighty important advantage at any depth . . . but especially at 10,000 ft. or below!

2. Buy Tru-Lay VHS in the longest practical length. Thus, with ample line reserve, cut-offs can be averaged-out to economically distribute wear and fatigue throughout the entire line.

3. Follow A Definite Cut-Off Schedule. Because practices vary from rig to rig and from location to location, it is essential for you to adhere to the specific cut-off schedule recommended for your operation.

For help in selecting the right cut-off practice for your lines, call our nearest field representative. When he visits you, he'll have a Ton-Mile Record Book containing reference tables and forms to assist you in carrying out his recommendations.

American Cable Division
AMERICAN CHAIN & CABLE

Bridgeport, Conn.
Factories at Wilkes-Barre, Pa., and Houston, Texas

ACCO
A C C
TRADE MARK

GOODYEAR INDUSTRIAL PRODUCTS
GM-Specified
Style WH Oil Suction & Discharge Hose (RB)
A
B
C
D
A Helix of flat, noncorroding, galvanized steel wire plus ply of heavy fabric coated with oil-resistant compound
B Tube of gasoline- and oil-resistant synthetic rubber
C Reinforcing plies of heavy fabric plus helix of round steel wire
D Oil-, age-, abrasion- and weather-resistant cover

Nearly three times the service—and still going strong!

Tankers are serviced very rapidly at this Texas dock. Standard operation is to load 138,000 barrels of gasoline in just 10 hours. Also standard is a test of the hose at periodic intervals to determine whether it can continue in service handling the highest test petroleum products or whether it should be relegated to low pressure, bunker or utility service.

Over eight years ago, the G.T.M.—Goodyear Technical Man—specified his Style WH Oil Suction and Discharge Hose for this service. At last report, this husky, 150-pound working pressure hose had repeatedly passed the high requirements of the exacting periodic tests and was well on its way toward delivering three times the expected service, handling gasoline, aviation gasoline, and solvents under high pressure.

If you're looking for the unusual in oil hose life, why not look up the G.T.M.? You'll find he carries a complete line of oil hose from which to specify the right types for your needs at lowest end cost. And he's readily available through your Goodyear Distributor or:

Goodyear, Industrial Products Division
Akron 16, Ohio

OIL SUCTION and DISCHARGE HOSE by

GOODYEAR

THE GREATEST NAME IN RUBBER

IT'S SMART TO DO BUSINESS *with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."*

QUICK RESPONSE TO LOAD

so Garvey Drilling Company standardizes on "Jimmy" Diesels

"The general swing is to 'Jimmy' Diesel in the oil fields here," says Claude W. Bard, of Garvey Drilling Company, Wichita, Kansas, who recently put their 16th GM Diesel-powered rig to work. "GM Diesels respond with instant starts, regardless of weather conditions, and recover RPM quickly when load is applied."

"The GM engine provides dependable, trouble-free service in return for just standard maintenance that takes little time and involves only minor expense." True—and the reason is its rugged, simplified 2-cycle design—lower cost parts—and ready availability of parts and service wherever you go.

Whether you're drilling on land or offshore, "Jimmy" Diesels give you the power to make hole at lowest cost. Write us or ask your GM Diesel distributor for 16-page catalog, "GM Detroit Diesel Petroleum Engines." It covers the complete line of oil-field power units—30 to 893 H.P.

DETROIT DIESEL ENGINE DIVISION OF GENERAL MOTORS, DETROIT 28, MICH.

GM DETROIT DIESEL POWER

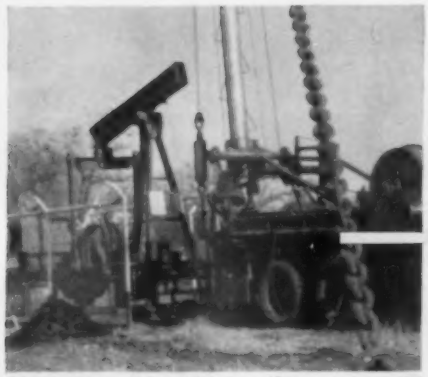
Regional Offices: New York, Atlanta, Detroit, Chicago Dallas, San Francisco

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

Now—more than ever—it pays to standardize on GM Diesel—available in 1485 applications of power equipment built by more than 175 manufacturers.

GENERAL MOTORS GOLDEN MILESTONE

Garvey's Rig #22, powered by GM "Twin 6-110" Diesel driving Wilson Super Mogul draw works and 7½" x 14" mud pump, drilling near Greensburg, Kansas. Completed 4800-ft. round trip in three hours.



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whether it's in a pumping well,
flowing well, flowline,
pipeline or storage tank . . .

BECAUSE OF THIS

efficiency-robbing paraffin deposits that
accumulate on well tubing and rods,
cut the effective diameter of pipe, or
cause a loss in valuable storage tank capacity . . .

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**THE SAFE, EFFICIENT
CHLORIDE-FREE WAY
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*SOLVO contains
neither carbon bisulfide
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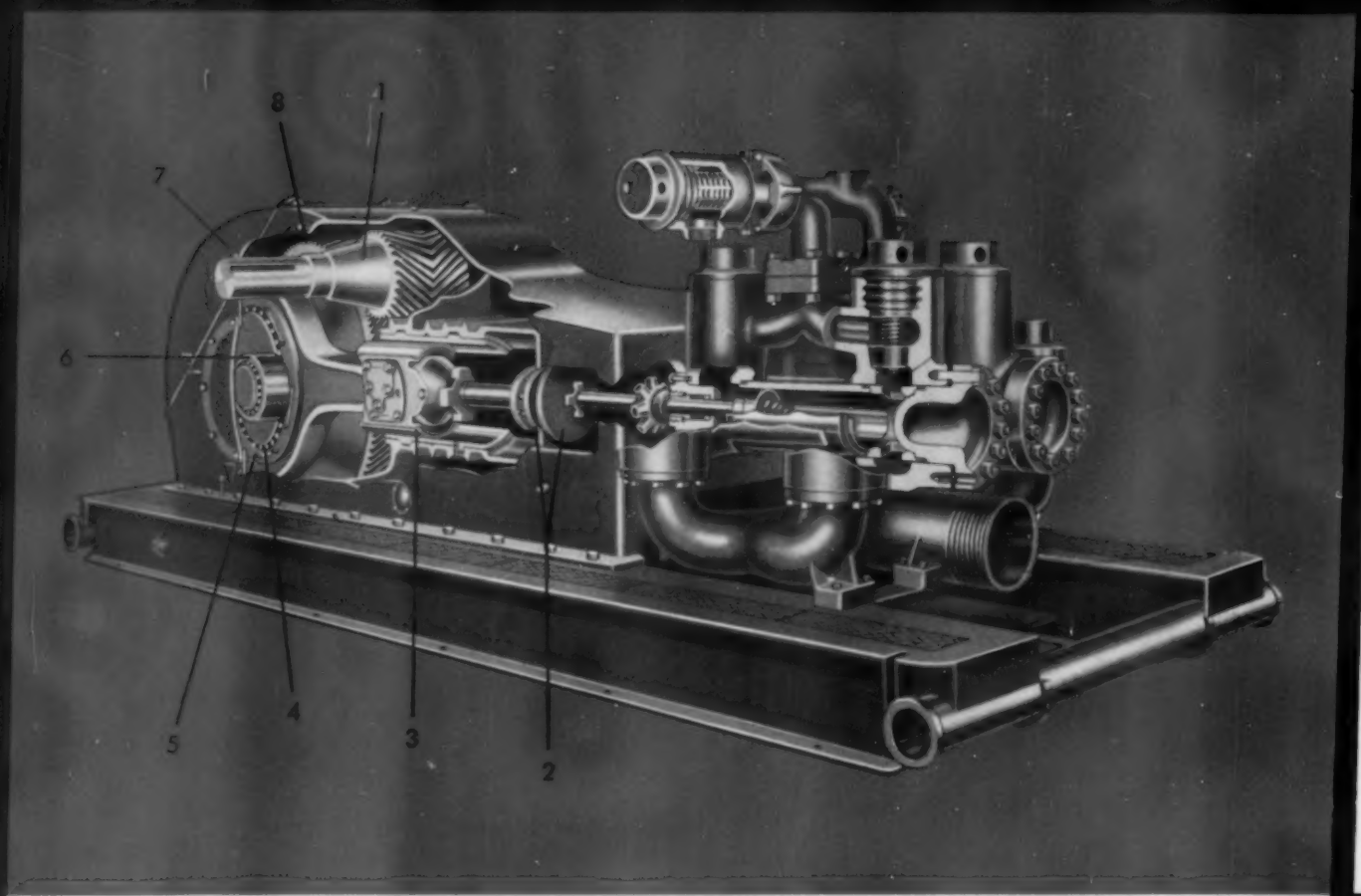

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is insured by

Continental-Emsco Power-End *design*

By the cross sectional drawing, you can see why Tool Pushers and Drillers place so much reliance in the power ends of Continental-Emsco slush pumps. In addition to their rugged construction, these power ends are surprisingly lightweight due to their *Fabriform* construction. In this new concept of pump design, the conventional heavy, bulky casting has been replaced by steel plates, formed and fabricated into a compact, rigid frame. You get *more horsepower per pound* than in any other slush pump.

POWER END FEATURES

1. One-Piece, Forged-Steel Pinion and Shaft
2. Packing Gland and Rubber Baffle Keeps Mud From Power End
3. Replaceable Crosshead Slippers and Frame Guides
4. One-Piece Eccentric Straps, Equipped With Large-Diameter, High Capacity, Retainer-Type Roller Bearings
5. Combination Splash-and-Pressure Lubrication System
6. Roller Bearings Used Throughout
7. All-Steel, Fabriform Constructed Power End
8. Demountable, Forged-Steel Herringbone Gear

Continental-Emsco "D" Series Slush Pumps give you all these wanted, needed fluid end features

* Precharged Pulsation Dampener
* 360° Swiveling Screen, Protects Discharge
* Heavy, Coarse-Pitch Threaded Valve-Pot Covers
* Cylinder Head Lock Liner

Shear Relief Valve

Liners Packed at Both Ends, Exposed to View

Screw-Type Stuffing Boxes

Two-Piece Fluid End on DA-850 and D-1000

Four-Runner Skid, Standard on D-700, DA-850, D-1000

* All models except D-175 and D-300

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SP711

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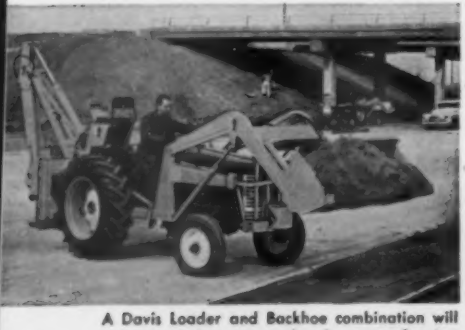
what's it worth to handle ticklish jobs?

DAVIS BACKHOE lets you work in Tight Spots!

Digs flush when you need to — only the Model 210 Davis Backhoe has the ability to dig flush alongside walls, buildings, fences. Has 200° continuous operating arc.



A Davis Loader and Backhoe combination will put money in your pocket by outperforming any other rig — pound for pound, dollar for dollar.

Digging near pipelines, conduits, utility mains, or other hidden obstructions is always a tough assignment . . . but a Davis Backhoe will let you handle those ticklish jobs easier and quicker with more safety and profit than any other make. Here's why!

DAVIS LETS YOU SEE YOUR WORK — Unobstructed visibility lets you work fast and accurately without having to "feel" your way around concealed objects or depend upon shouts and hand signals for instructions. Both seat and finger-tip controls swing with the boom, so you always face your work.

DAVIS HAS "ALERT" CONTROLS — Boom, dipper stick, bucket, and stabilizer foot respond lightening-fast to your command.

DAVIS GIVES MAXIMUM MANEUVERABILITY — Because of its exclusive flush digging feature, 200° continuous operating arc, and ability to dig at right angles, Davis lets you operate in places inaccessible to other machines. You can often complete jobs in the time it takes other makes to maneuver into position! . . . ***YET DAVIS STILL COSTS LESS THAN MOST OTHER MAKES!***

Davis Loaders and Backhoes are available for all popular models of International, Ford, Fordson Major, Ferguson, Case, Massey-Harris, Allis-Chalmers, Oliver, John Deere, Minneapolis-Moline, and Work Bull Tractors.

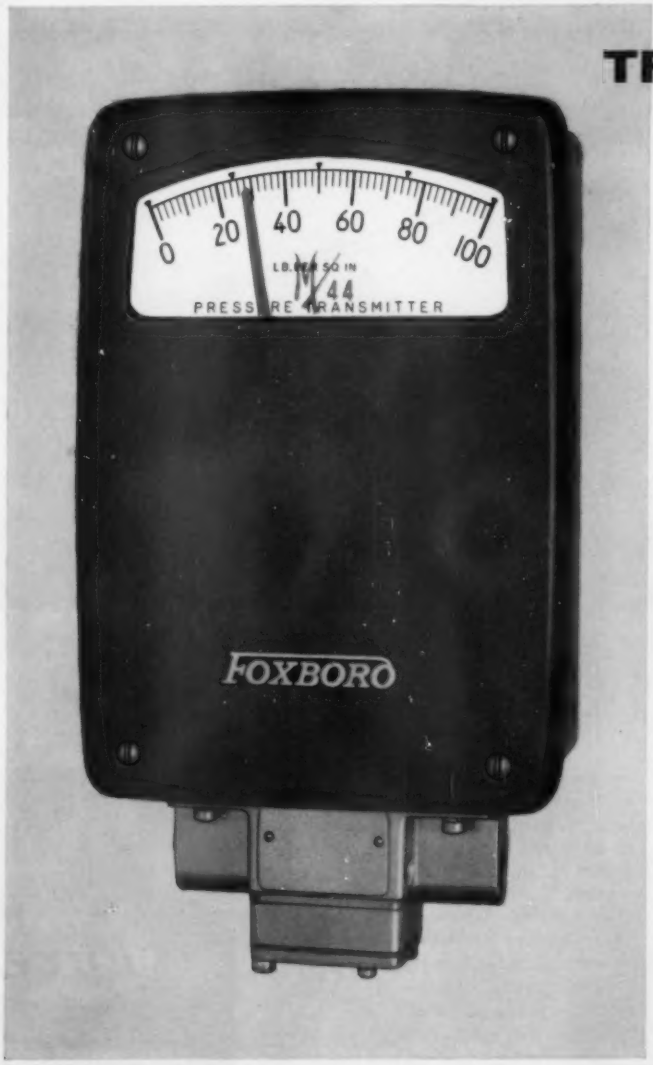
SOLD AND SERVICED EVERYWHERE BY BETTER DEALERS

For the name of your nearest dealers call Western Union by number and ask for Operator 25 . . . or write direct. Please specify make of tractor.

MASSEY-FERGUSON INDUSTRIAL DIVISION
MASSEY-HARRIS-FERGUSON, INC.
1009 S. WEST STREET • WICHITA 15, KANSAS

read pressure up to 20 ft. away!

on the FOXBORO M/44 INDICATING PRESSURE TRANSMITTER



You can check pressure readings at a glance on the Foxboro Pneumatic Indicating Pressure Transmitter. Its open-face, horizontal, 4-inch indicator scale and eye-catching red pointer are clearly visible as far away as 20 feet.

But high readability is just part of the story. Actually, this instrument was engineered from the ground up. Makeshift arrangements have been eliminated, hung-on gauges are gone. Everything is included in one, neat, ready-to-install package.

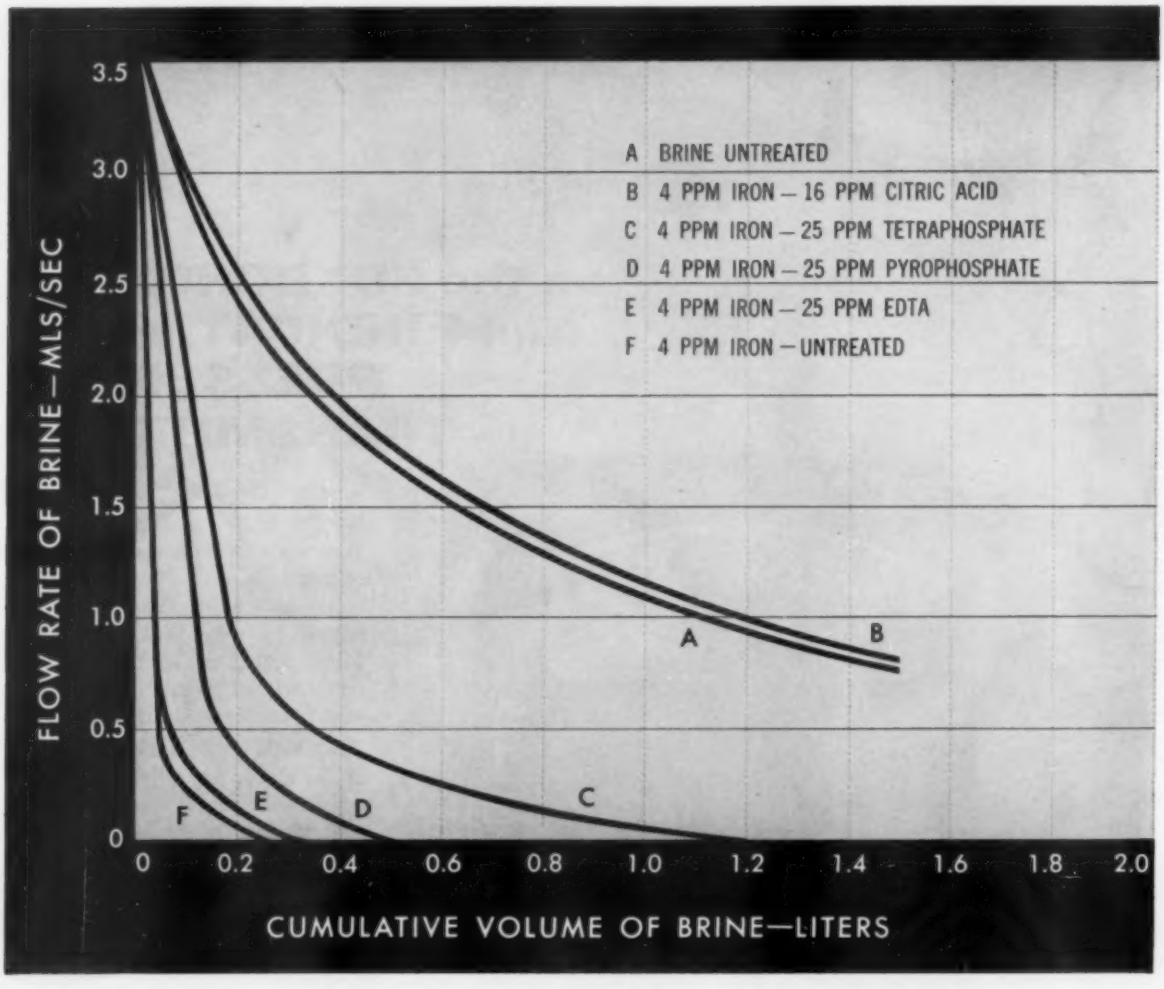
Because the indicating pointer is direct-connected to element and transmitter, calibration is easy . . . and you can re-zero the transmitter externally. All M/44 components are standard, performance-proved Foxboro parts. This makes it easier to stock and service.

From its compact, drawn-steel case to its tough, polyester plastic cover the M/44 is the high-efficiency, low-cost pressure transmitter for centralized control and operation. All standard ranges.

Write for complete details. **The Foxboro Company, 603 Neponset Ave., Foxboro, Mass.**

FOXBORO REG. U.S. PAT. OFF. **INSTRUMENTATION FOR INDUSTRY**

Avoid Iron Plugging in Secondary Recovery



Add Citric Acid to Injection Water!

● The graph you see here shows the results of water treatment experiments that compared the effectiveness of Pfizer Citric Acid with a number of other commercially available sequesterants. The points where the flow rates have decreased to zero indicate the plugging volume of the solutions. Pfizer Citric Acid was the only sequesterant tested which maintained flow rates comparable to iron-free brine.

In the tests, conducted at the Pfizer Technical Service laboratory, a synthetic brine containing calcium and magnesium ions was prepared. Four samples were treated with different sequestering agents and soluble iron, one sample with soluble iron alone. A sixth sample remained untreated.

Flow rates were determined by passing the above solutions through membrane filter discs which contain 50 million uniform sized pores per square centimeter. These uniform pores approximate the pore size of the sandfaces through which your injection water must flow. The results, as you can see from the chart above, proved conclusive. Citric Acid was far superior in preventing the formation of insoluble iron compounds—kept flow rates highest.

If you want to stop iron from plugging sandface pores, add Pfizer Citric Acid to your injection water. It's nontoxic, safe to handle, and high calcium and magnesium waters do not interfere with its iron sequestering action.

Pound for pound, Pfizer Citric Acid not only sequesters iron better, but also at less cost than any other agent.

For full information write to:

Manufacturing Chemists for over 100 Years

Pfizer

CHAS. PFIZER & CO., INC.
Chemical Sales Division
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Branch Offices:
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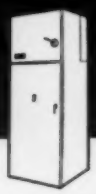
Newly designed
Type H Motor Control



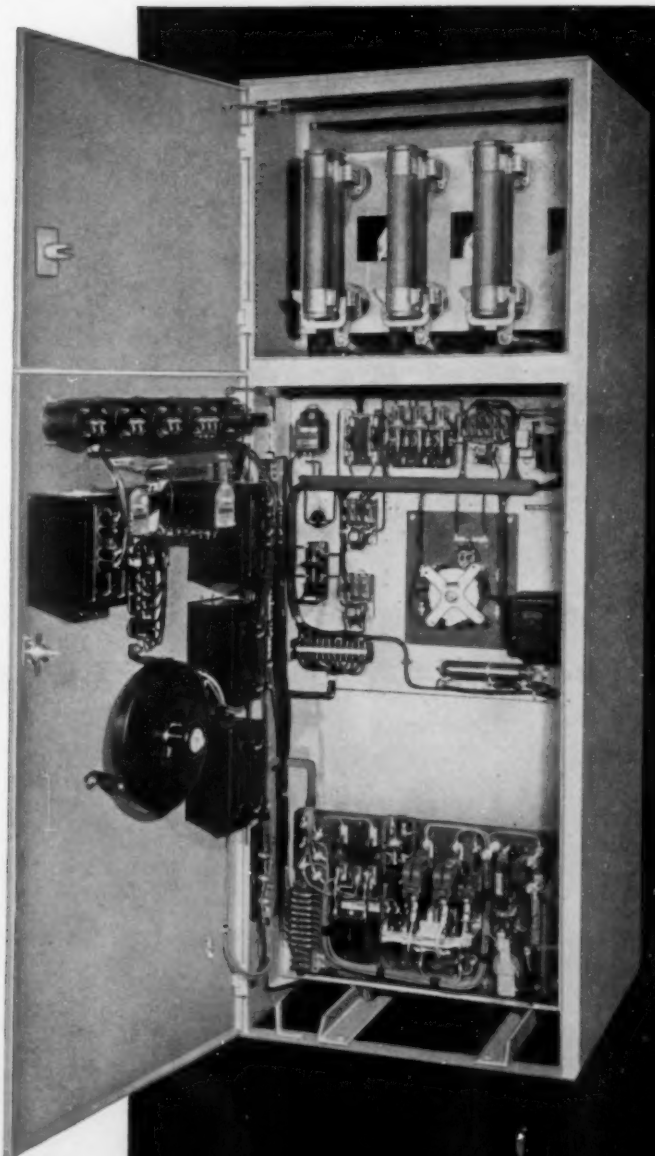
More room for optional features

Now, with Allis-Chalmers high voltage control, you get more panel space for additional components.

Meters, pushbuttons, instruments, rheostats, indicating lights, relays, and other components can be installed—thanks to the ample space available on both the outer door and inner barrier.

Along with more room, this new A-C design is front accessible, has smaller cabinet size, provides ultimate in protection for men and machines, and has been completely tested.

For more information on this engineering advance, contact your A-C office or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

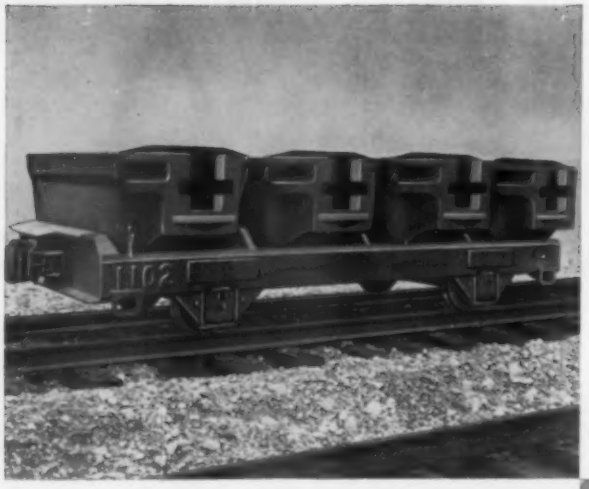


All this area on Allis-Chalmers new Type H motor control is available for optional features. In many applications, this extra space eliminates the need for an extra cabinet.

Removable panel, on which control devices are assembled, is mounted on inner barrier. Entire panel may be quickly removed for inspection and maintenance.

ALLIS-CHALMERS A-C

A-5519

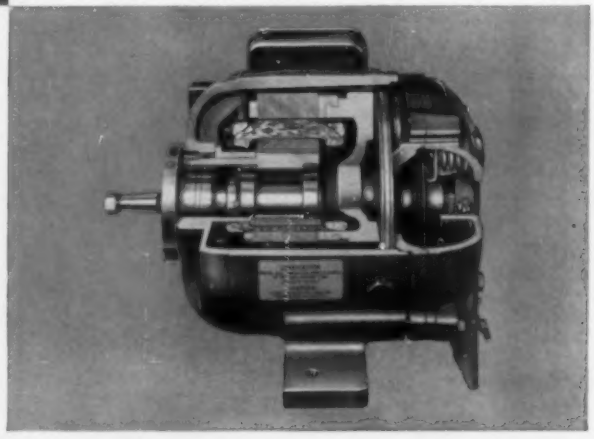


THE HEAVIER THE LOAD...

the more you need HYATTS . . . because nothing can compare with the cylindrical roller bearing for rugged, load-carrying capacity and continuous operation under adverse conditions. That's why leading steel mills specify HYATT Hy-Rolls for applications like these charging cars.

THE HIGHER THE SPEED...

the more you need HYATTS . . . because their internal clearances are stringently controlled for smoother operation. Built of the finest steels, HYATT Hy-Rolls operate with peak efficiency at high speeds as in this non-ventilated, continuous-duty textile loom motor.



Cylindrical

THE MORE YOU NEED ▲ HY-ROLL BEARINGS

Today, as new industrial designs require heavier loads and higher speeds crammed into smaller housings, engineers are turning to HYATT Roller Bearings, America's most complete line of cylindrical roller bearings. They find their problems are solved quickly with bearings like the shouldered-race HYATT Hy-Roll that will handle heavy radial loads while taking a surprising amount of thrust. Contact your nearest HYATT Sales Engineer for recommendations—You'll find him a mighty big help! Hyatt Bearings Division, General Motors Corporation, Harrison, N.J.; Pittsburgh; Detroit; Chicago; Oakland, California.

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

1908–1958 GM FORWARD FROM FIFTY

HYATT HY-ROLL BEARINGS FOR MODERN INDUSTRY

Stems can't seize...

BRONZE TRIM FIG. 333

ALL-IRON TRIM, FIG. 337

Both of these OIC Duo-Bolt gates have special stems. The Fig. 333 stem is OIC *Alloy-40* in sizes 2" and under . . . corrosion-resistant bronze with 20 to 30 times longer life than most other stem bronzes. It will not gall or seize. In fact, this alloy has all but eliminated stem replacement. The Fig. 337 stem is nickel-plated steel . . . highly resistant to pitting in the packing area, sturdy and long wearing.

Design includes bonnet drain ducts . . . recessed gasket seat

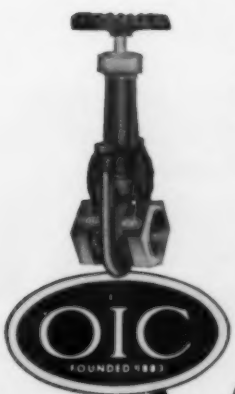
To protect against freezing, bonnet ducts allow complete drainage of the upper part of the valve. The male-female, gasketed body-bonnet connection assures a tight joint and prevents blown gaskets.

Exclusive cast-in seat rings

On sizes 2" and under, bronze trimmed valves include cast-in seat rings, *rolled* to make doubly sure that they cannot loosen in service. On sizes 2½" and larger, seat rings are screwed in. Seats are integral on all-iron trim valves. Both types include a button-head stem-to-wedge connection, flexible for non-binding wedge seating.

Immediate availability . . . long line

Order Duo-Bolt gates from your OIC Distributor or his field store. Sizes: ¼" to 4"; screwed or flanged ends. Working pressures: 125 to 150 lbs. WSP, 200 to 225 lbs. cold WOG, non-shock. Request Form No. 1007 for more information.



P-509

VALVES | FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

Engineering Progress Report
FROM UNION CARBIDE CHEMICALS COMPANY

Glycol Dehydrators give 90°F. Dew Point Depressions...

Improved regeneration systems give high glycol concentrations

There are two methods commonly used today to dehydrate natural gas: one employs glycols; the other, dry desiccants. Most authorities agree that glycol systems are less expensive in both initial and operating costs. Recent engineering advances now permit dew point depressions up to 90°F. with economical glycol-type dehydrators. Union Carbide Chemicals Company maintains an extensive engineering service group designed to help the natural gas industry obtain the best possible dehydration service with CARBIDE's diethylene glycol and triethylene glycol.

A GRADUAL IMPROVEMENT

Diethylene glycol was first used to dehydrate natural gas in 1936 and by 1939 sixteen glycol type plants were in service providing average dew point depressions in the range of 40°F. Triethylene glycol was first used to dehydrate natural gas in 1949. The dew point depressions realized with glycol type plants have gradually increased until today the standard guarantee is a 65°F. depression or gas containing seven pounds of water per MMSCF, whichever first occurs. For sometime now, some equipment manufacturers have offered a 75°F. dew point depression guarantee.

FACTORS INFLUENCING DEW POINT DEPRESSION

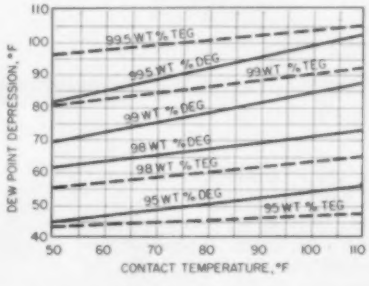
The dew-point depression obtained with a glycol dehydration plant depends upon several factors, such as:

1. Concentration of water in the lean glycol solution.
2. Glycol circulation rate.
3. Contact temperature in the top of the absorber column.
4. Efficiency of gas to glycol contact in the absorber.

Even with conservative design and operation, however, the dew point of the gas leaving the glycol contactor cannot be lower than the equilibrium value for the conditions of temperature and glycol concentration found on the top plate.

HIGH GLYCOL CONCENTRATIONS

The high diethylene and triethylene glycol concentrations now being obtained in plant practice, prompted studies to determine the dew point depressions obtainable with such solutions.



These data indicate that both diethylene and triethylene glycol at 99.5 per cent concentrations provide dew-point depressions in the 80°-105°F. range.

At concentrations of 98 per cent and lower, diethylene glycol provides better depressions than equal concentrations of triethylene glycol, while at 99 and 99.5 per cent concentrations, triethylene glycol appears to allow a 5°-10°F. lower dew point than diethylene glycol.

90°F. DEPRESSION MEETS TRANSMISSION REQUIREMENTS

Glycol regeneration equipment on the market today is capable of producing and maintaining glycol concentrations above 99%. Thus, it is possible for equipment manufacturers to guarantee a 90°F. minimum dew point depression. There are very few instances where a 90°F. depression will not meet the water content specifications of any long distance gas transmission company.

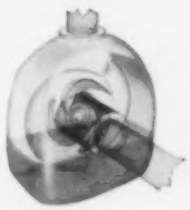
CARBIDE'S RESEARCH PROGRAM

Dew point depression studies are but one phase of CARBIDE's extensive research activities designed to improve the products and processes of the natural gas treating industry. CARBIDE's Technical Service Department stands ready to help you obtain the best possible results from your gas treating installations. For more information on the use of CARBIDE's glycols for gas dehydration, call the nearest CARBIDE technical representative or write, Union Carbide Chemicals Company, Department B, 30 East 42nd Street, New York 17, N. Y.

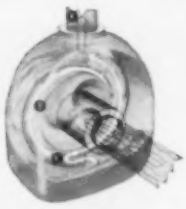
"Union Carbide" is a registered trade-mark of Union Carbide Corporation

UNION CARBIDE
CHEMICALS
Union Carbide Chemicals Company
Division of Union Carbide Corporation
30 East 42nd Street, New York 17, N. Y.

THESE PORTABLE PUMPS PRIME AT 30 FEET LIFT!



PUMP AT REST
Captured liquid retained for priming. Note absence of the usual check valve.



PRIMING ACTION
Entrained air (B) escapes at (A) to be discharged. Priming liquid returns (C) to entrain more air.

PUMPING ACTION
Straight-in suction voids entrance restrictions. Water enters direct to the eye of the impeller.

When rain, springs or seepage is clobbering construction, it's good to have Gorman-Rupp "80" Series Pumps ready in the equipment pool.

These new pumps prime and reprime at lifts of up to 30 feet. They move easily because of their lightweight, aluminum construction. (The Midget weighs only 48 pounds.)

Look at the cutaway views. *Straight-in suction* delivers liquid directly to the impeller's eye. Capacity, efficiency and suction lift are increased. No *check valve.*

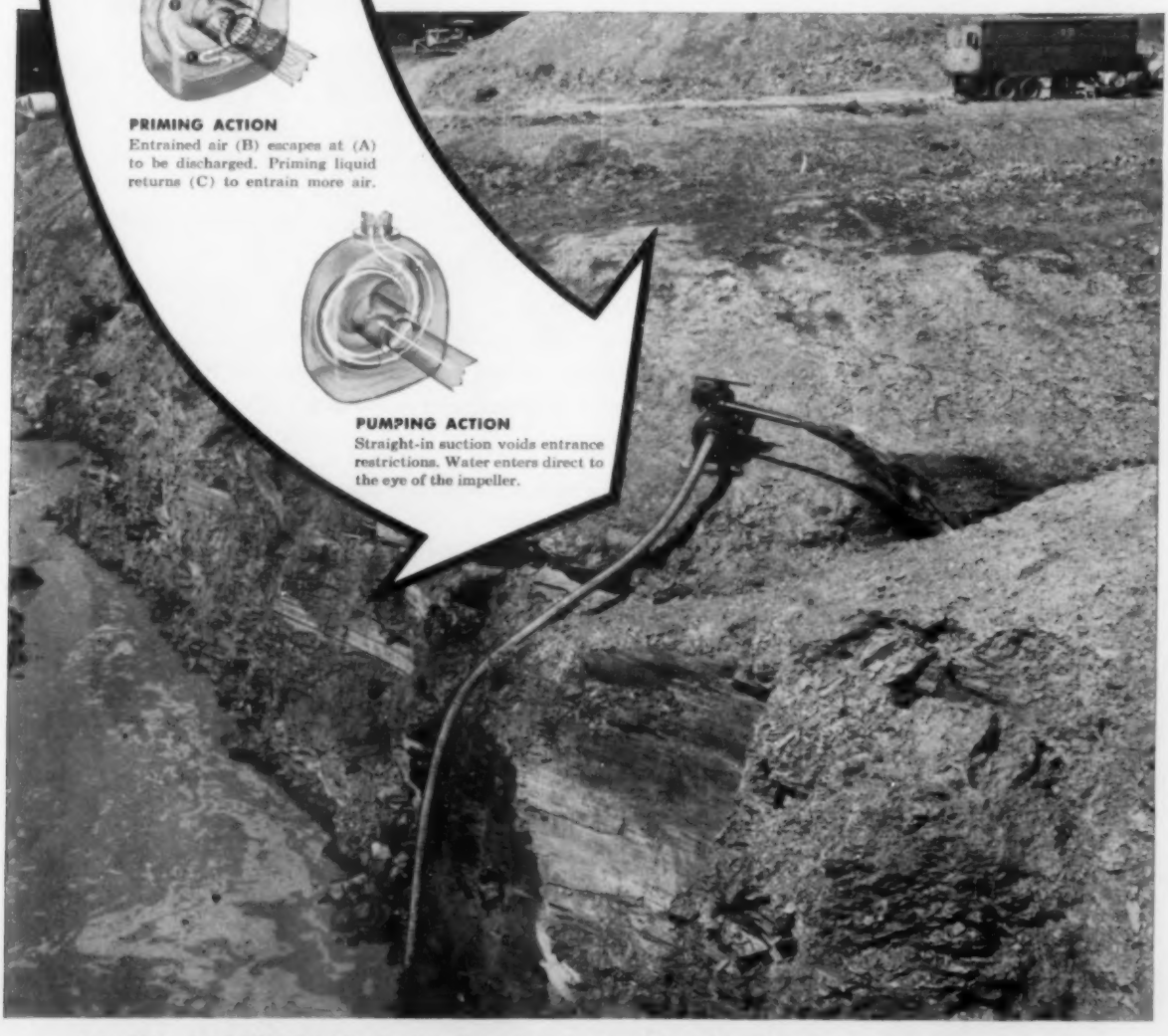
Four models:

Midget, 1½", 6,500 GPH, 2.25 HP;
Pelican, 2", 8,500 GPH, 2.75 HP;
Hawk, 2", 12,000 GPH, 5.5 HP;
Eagle, 3", 18,000 GPH, 6.8 HP.

You saw them at the Road Show. Buy them now at your Gorman-Rupp Distributor.

THE GORMAN-RUPP COMPANY

305 Bowman Street • Mansfield, Ohio



MIDWEST & GULF COAST OILFIELD REPRESENTATIVE: HENRY H. PARIS DISTRIBUTOR, INC., HOUSTON, TEXAS

PORTRAIT OF A PROUD EXECUTIVE

His company just received dividends totaling thousands of dollars on its workmen's compensation insurance . . . because he chose Texas Employers' Insurance Association as his insurance carrier.

This executive realizes that insurance costs are as much a part of operating costs as raw materials, labor or taxes. And he is justifiably proud of his judgment in choosing TEIA to help him reduce his expenses.

This example is re-enacted each year by hundreds of policyholders of Texas Employers'. TEIA was created to insure employers at *cost*. During 1957, it saved and returned to policyholders over $4,500,000 in dividends and discounts, making a total of over $55,500,000 returned since organization.

Call your nearest TEIA office today for an estimate of the savings possibilities available to your company. You'll be glad you did.

THERE'S AN OFFICE NEAR YOU

TEXAS EMPLOYERS' INSURANCE ASSN. DALLAS, TEXAS

Symbol of leadership in
WORKMEN'S COMPENSATION
Insurance

•

Outstanding opportunities in Sales, Claims, Engineering and other departments for qualified young men.

TEXAS EMPLOYERS
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HOME OFFICE Employers Insurance Building DALLAS, TEXAS

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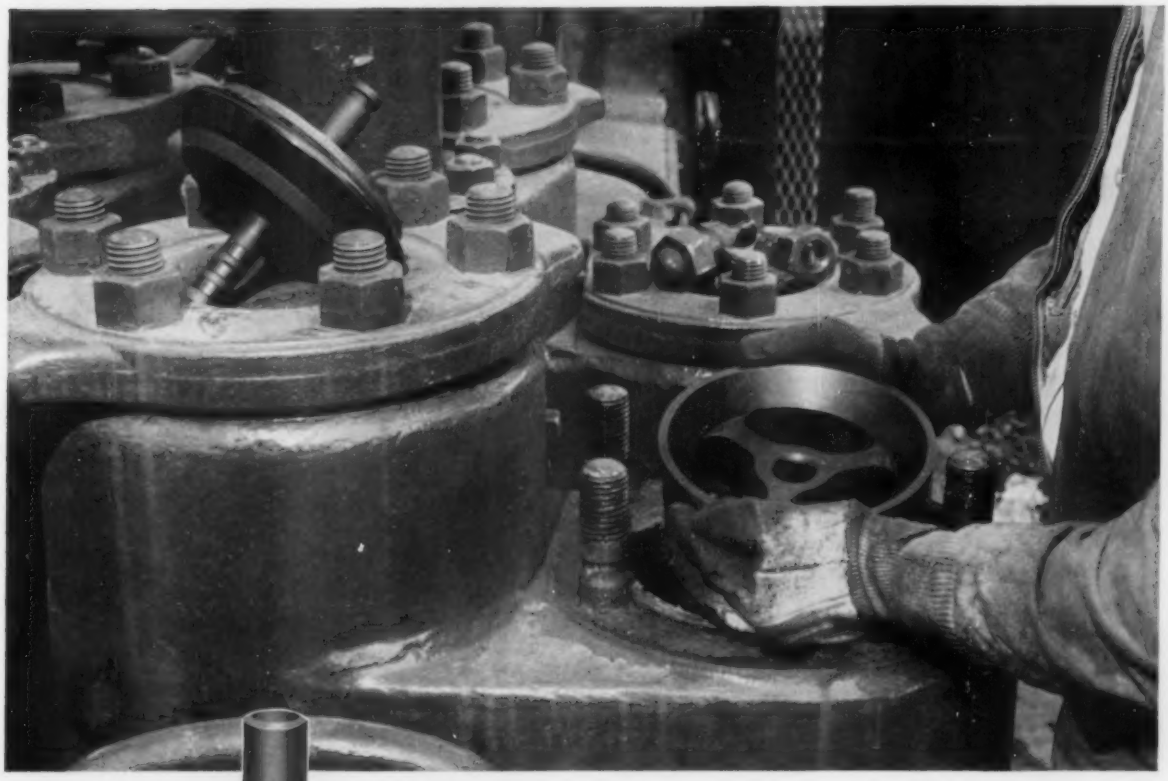
Why AMERICAN IRON Slush Pump Valves & Seats Outlast and Outperform All Others!



BUILT FOR HIGH PRESSURE OPERATION . . . three web seat for maximum fluid flow plus reduced flow velocity (this means maximum fluid end capacity on suction stroke and less wearing of valve seat by abrasive muds) . . . round lip insert for smoother running pumps (round lip on insert minimizes fluid turbulence between valve and seat—reduces wear and results in smoother pump operation) . . . split ring retainer for 360° support of insert (insert is held rigid and supported at all points—reduces chances of chipping or cracking of insert material).

These American Iron design-features assure longer valve and seat life . . . greater trouble-free pump operation on *your* rigs.

American Iron valves and seats are manufactured for every slush pump. Send now for folder covering installation, maintenance procedures and suggestions for longer valve and seat life.

Available through your Supply Store

Another AMF Product
PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
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AMERICAN IRON & MACHINE WORKS CO. INC. • OKLAHOMA CITY •

Naugatuck KRALASTIC

Extruders make ready new, higher-rated lines of IPS and SWP KRALASTIC PIPE

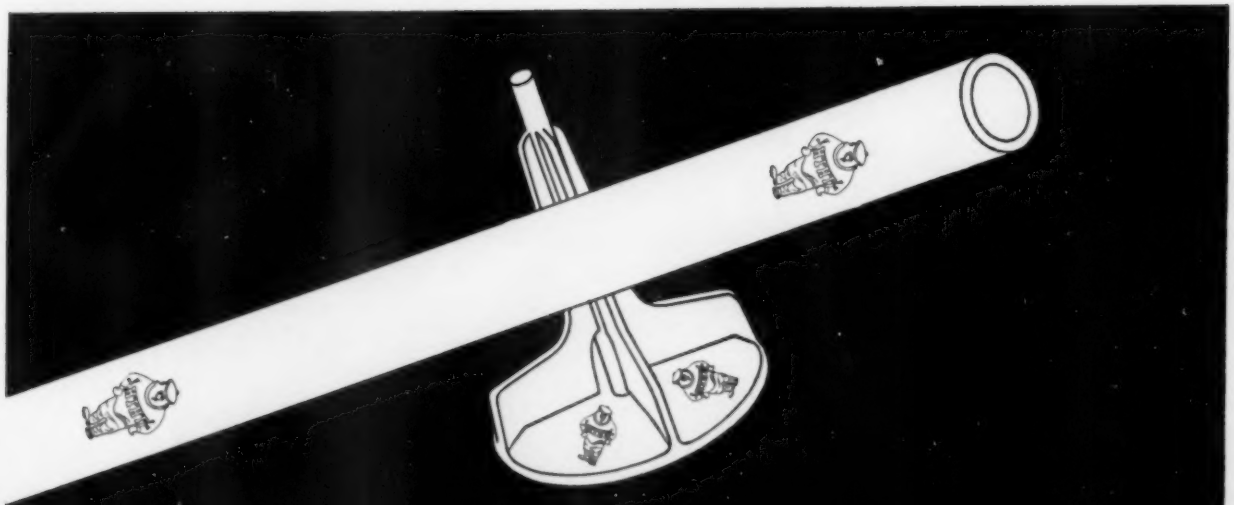
Because of its proved durability, toughness, flexibility, chemical resistance, light weight and speed of installation, pipe made of Kralastic® has earned a unique position in the field of thermoplastic pipe.

This is evident from the more than 7,000 miles of Kralastic pipe now installed for such uses as:

- Carrying natural gas
- Gathering lines, flow lines and salt-water disposal lines in the oil fields
- Jet well piping
- Transporting potable water (N.S.F.-approved)
- Underground sprinkler systems
- Handling corrosive liquids in paper, chemical, food-processing and water-treatment plants
- Conduit for electrical wiring

Not content with having produced the *best* pipe-extruding compound of its kind, Naugatuck's research and development chemists have been at work for some time on a

Look for "The Champ" symbol at dealers selling pipe made of Kralastic HTHT... and eventually on the pipe itself.



A new thermoplastic extruding and molding compound

that provides

HIGHER TENSILE STRENGTH ● HIGHER TEMPERATURE RESISTANCE

and opens up many new uses for

KRALASTIC PIPE and ● KRALASTIC MOLDED PARTS

compound having even higher tensile strength and capable of withstanding higher temperatures without distortion. Kralastic HTHT is the result.

Extensive new facilities for the production of Kralastic HTHT are now being completed. Meanwhile, limited quantities of the compound have been released to Kralastic extruders who have planned a new range of IPS and SWP sizes and ratings of pipe and fittings to take advantage of its greatly improved strength and temperature properties. These new lines of pipe make it possible for many new users to enjoy the economies and durability of Kralastic pipe in still more fields of application.

These advantages can be yours if you make certain that the plastic pipe you buy for high-pressure or high-temperature service is made of Kralastic HTHT. It's your assurance of satisfaction.

If you would like a list of pipe manufacturers using Kralastic HTHT...or if you are interested in its possibilities for your own production of extruded products or molded machine parts, write us today.

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United States Rubber

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328K Elm Street
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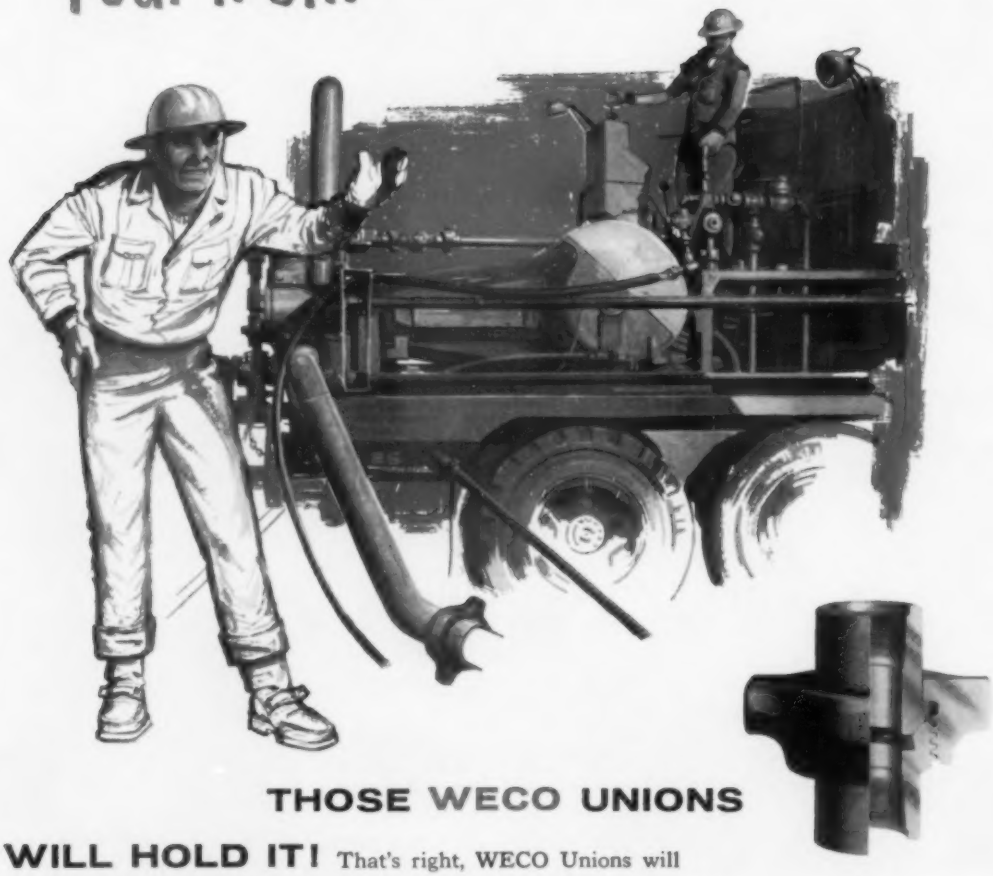
Pour it on!



THOSE WECO UNIONS

WILL HOLD IT! That's right, WECO Unions will hold the high pressures of today's — and tomorrow's — service jobs without leaking. Full-circle metal-to-metal contact sealing is always maintained by WECO's ball and cone seats. The strong forged steel nuts and subs can take the hard treatment of fast make-up and high-pressure shock and vibration.

You can rely on WECO Unions for your well service work and rig piping. See your WECO salesman or order from your Supply Store today . . . available in sizes 1″ through 12″, in pressures from 1,000 through 15,000 psi.

U-3-58

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

There's only one fingerprint like this ☞

and there's only one trade-mark like this ☞

TIMKEN®

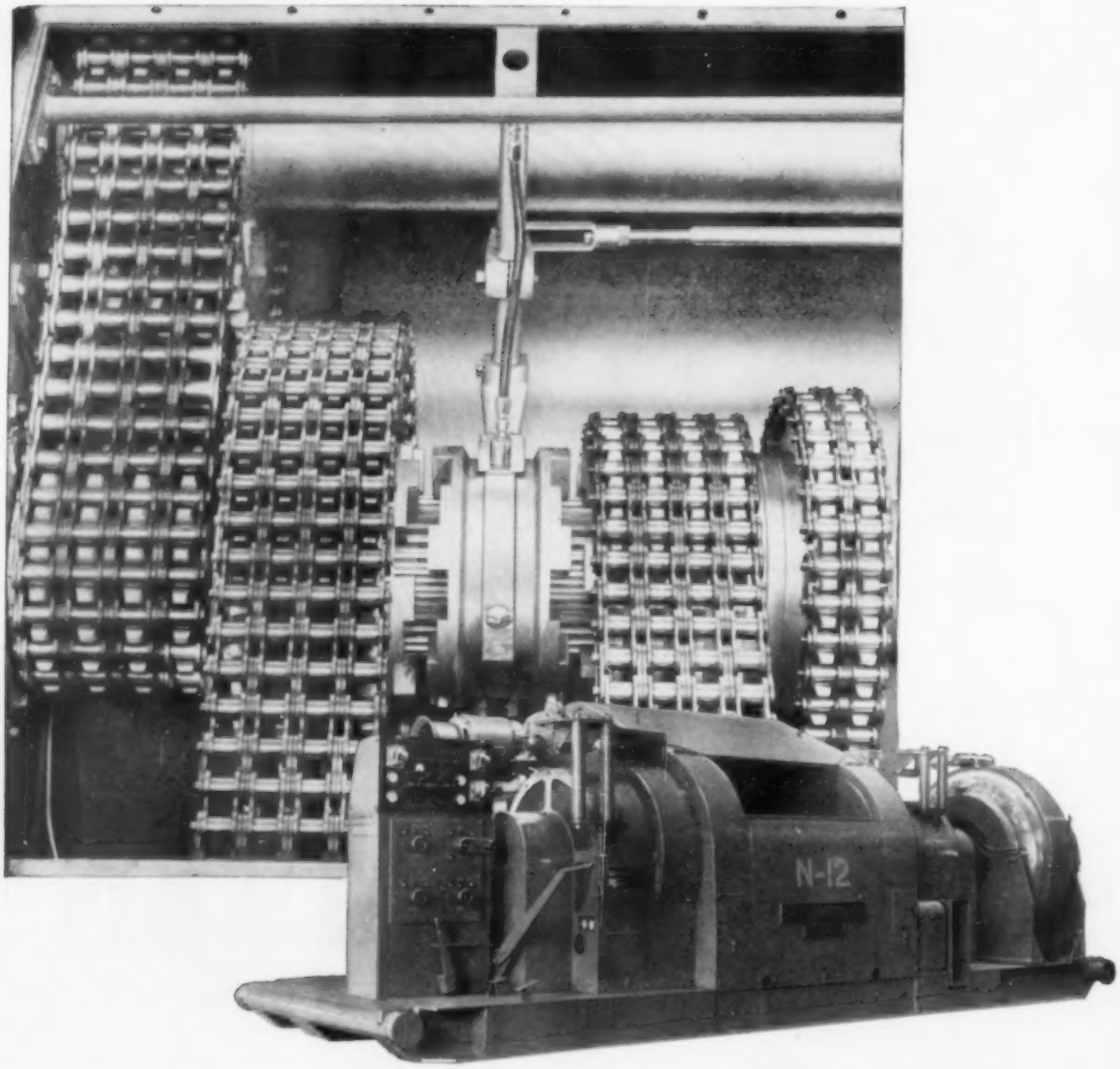
THERE'S only one registered trade-mark that says "Timken". It belongs to The Timken Roller Bearing Company, alone. You'll find it on every Timken Company product, whether it's tapered roller bearings, fine alloy steel bars, seamless steel tubing or removable rock bits.

When you see the trade-mark "Timken", you can be sure the product it marks is highest quality. Quality that is known and looked for throughout industry. Quality that is backed by more than 55 years of experience—guarded by 15,000 Timken Company employees.

That's why it's worth your while to remember that "Timken" is a trade-mark, not just a type of product. When you want the best, look for the trade-mark "Timken". It's the name you know means highest quality.

The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

TAPERED ROLLER BEARINGS • REMOVABLE ROCK BITS • FINE ALLOY STEEL



There's good chain in this Brewster

Brewster chose Rex Chain for this drawworks because Brewster demands standards of performance that Rex is able to meet.

Basically these standards add up to a long life of profitable drilling in an exacting service where profits must be watched closely.

Part of the profit will be realized in the elimination of unnecessary down time. The "glide fit" design of Rex Roller Chain makes assembly and disassembly fast and easy.

More of the profit will be realized from the always continuing program of product improvement which is a CHAIN Belt tradition. There is no roller chain stronger and more resistant to wear and fatigue than today's Rex.

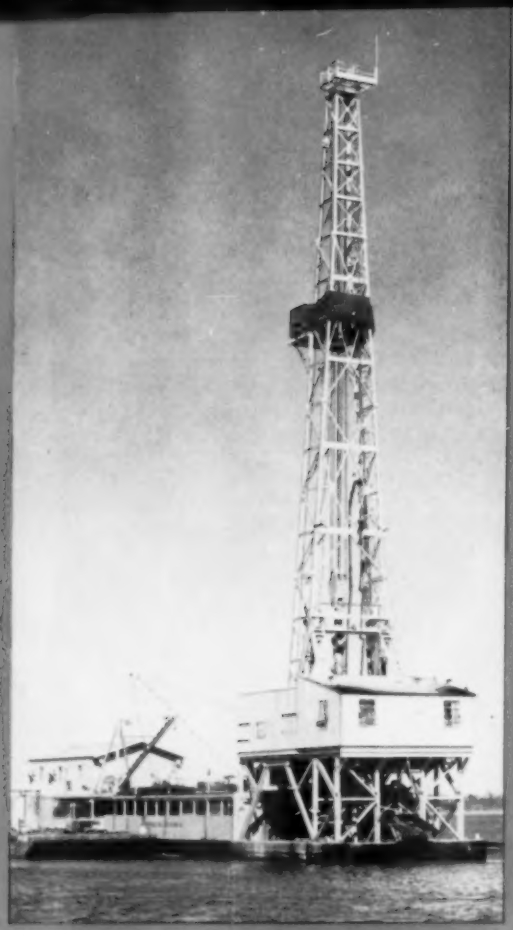
In drilling service, Rex Roller Chain is convenient—enduring—and profitable. See your supply store. CHAIN Belt Company, 4619 West Greenfield Avenue, Milwaukee 1, Wisconsin.

CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

Oil Field Offices: Dallas • Houston • Los Angeles • Odessa • Oklahoma City • New Iberia • New York

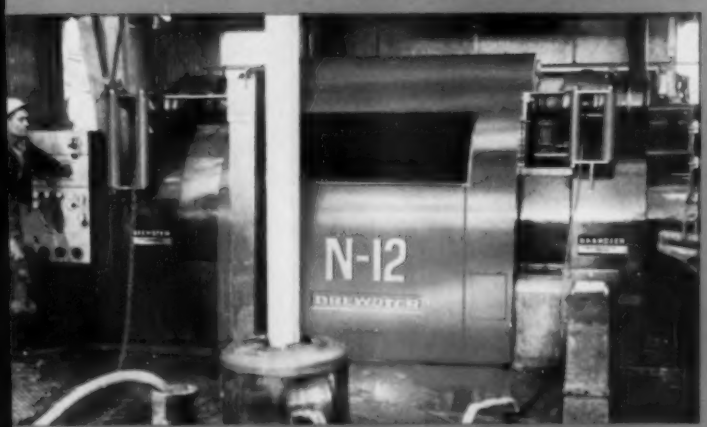
Export Offices: Milwaukee • New York



PENROD RIG 42

POWER-PACKED NEW DESIGN BY BREWSTER

Boasting over 100 horsepower for every foot of beam this new Penrod rig is a new concept in barge design. Gone are the frills and showboat accommodations. This new barge will drill to 20,000 feet and packs the equipment to do it in just 30 feet of width and 186 feet of length. Drawing only six feet under way she will go up to most locations without dredging or widening.



Let Brewster quote you on a drawworks designed to your special drilling requirements.

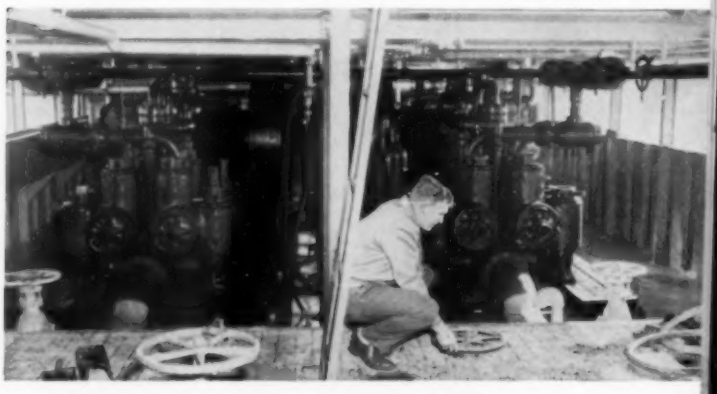
Turn the page to see the other power features of Rig 42

BREWSTER

J. P. Johnson, Superintendent for Penrod Drilling Company who originated the design for Rig 42, says, "This rig was built for maximum use of power, a minimum of barge, maximum rig. Its performance record has been excellent."

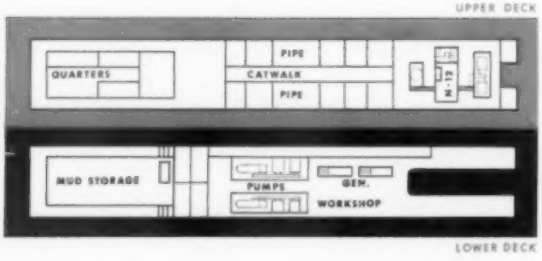
Starting top side Rig 42 has a Brewster N-12 Reserve Powered Drawworks. Two "Cat" Turbo charged D-397's furnish the power. A unique offset compound on the N-12 places the engines opposite each other. This shortens the overall drawworks and compound length to just 18' 6".

Capable of 20,000 foot drilling the Brewster N-12 has eight forward and two reverse speeds. Four speeds are available at the rotary table. A field proved design, the N-12 turned in a First Hole record of 11,200 feet in eleven days' time including spudding in and crooked hole trouble.

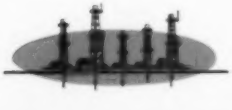


POWER-PACKED COMPOUND was designed by Brewster to fit Rig 42's new concept in barge design. Developing over 1200 horsepower the Turbo charged "Cats" are linked to the drawworks by a minimum of compound and chain, requiring only 10' 8" in depth behind the drawworks. Note how auxiliaries such as the air compressor and oil pumps have been placed to use a minimum of space yet they are completely accessible.

TWO PUMPS WIDE the hull wastes no space yet allows plenty of work room. Each pump is powered by two Turbo Charged D-397 "Cats". The full mud system can be seen in the foreground. Dry mud storage is provided in after section of first deck.



A 500-TON BREWSTER BLOCK and 8SX swivel handle the drilling string. The Rotary Table is a Brewster 27½". This "Matched Equipment" for the Reserve Powered Brewster N-12 gives Rig 42 a balanced team to speed drilling.

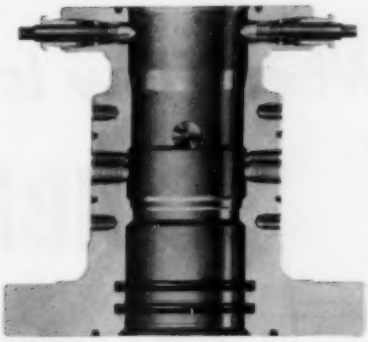


THE BREWSTER COMPANY, INC.

Shreveport, Louisiana

SUPPLY HOUSES

Howard Supply Company • Apex Equipment Company • Bovaird Supply Company • Industrial Supply Company • Murray Brooks, Inc. • United Supply and Manufacturing Company • Export Sales: The Brewster Company • (HOMCO) Houston Oil Field Material Company, New York, N. Y., Houston, Texas; Mexico City, D. F.



UNIVERSALLY ACCEPTED

THE UNIVERSAL TUBING HEAD
ANOTHER O-C-T ACHIEVEMENT

This new and highly versatile tubing head permits an operator, regardless of well conditions, to complete wells singly or dually at will with complete control at all times.

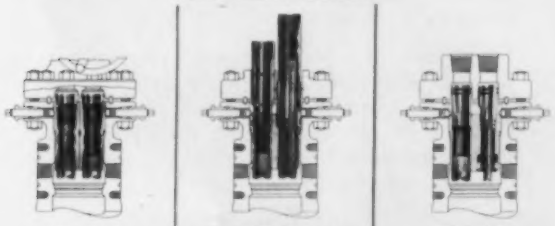
Whether you are drilling a well with a multiple completion in mind or not, the O-C-T Universal Tubing Head permits any last minute change in completion procedures without the necessity of changing tubing heads or using special attachments.

TYPE "UA" ATTACHMENT

Check these outstanding features:

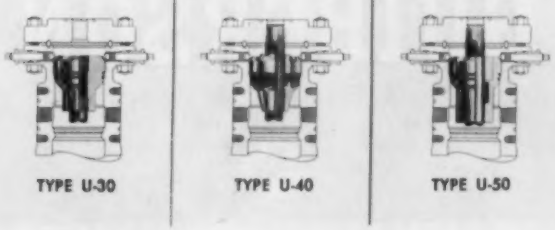
- Any API Head can be readily converted to a Universal by installing the UA attachment directly on top of the existing tubing head.
- Retractable aligning screws are used to align the dual hanger with respect to the head itself.
- These screws are placed in a retracted position when single string hangers are used.
- All hangers are run through, landed and locked in place prior to the removal of the blowout preventers.
- Once the head is installed, all seals can be field tested through test ports located in the flanges.
- The Universal Head is available in 600 through 2900 series and flange sizes from 6" to 10" for casing sizes 5½" through 7".

DUAL STRING HANGERS



TYPE U-60 TYPE U-70 TYPE U-80

SINGLE STRING HANGERS



TYPE U-30 TYPE U-40 TYPE U-50

NO OTHER TUBING HEAD IS SO RUGGED, NOR SO VERSATILE

where progress is a daily practice

O·C·T

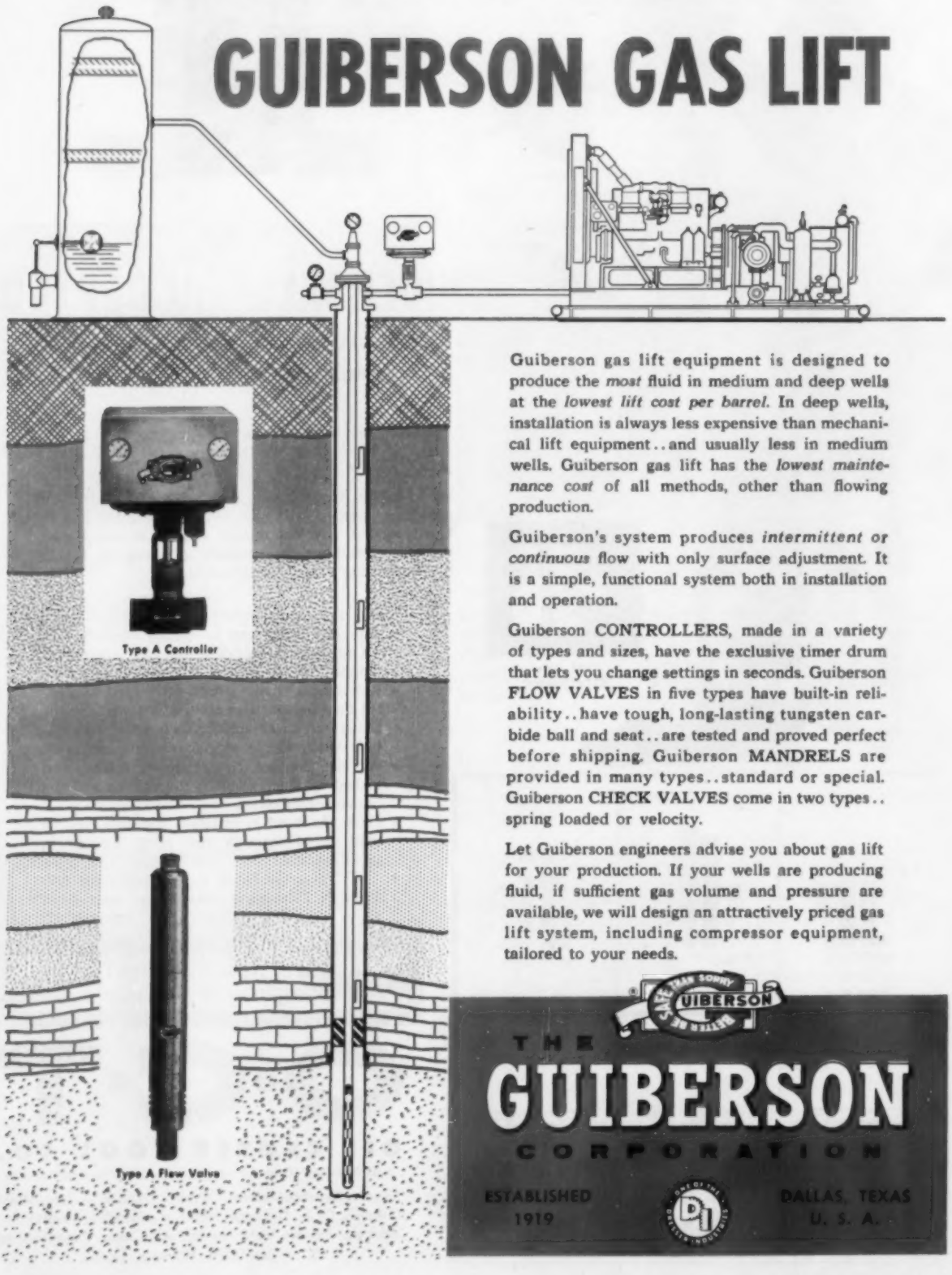
OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

When Flow Is Slow.. It's Time For

GUIBERSON GAS LIFT



Guiberson gas lift equipment is designed to produce the *most* fluid in medium and deep wells at the *lowest lift cost per barrel.* In deep wells, installation is always less expensive than mechanical lift equipment.. and usually less in medium wells. Guiberson gas lift has the *lowest maintenance cost* of all methods, other than flowing production.

Guiberson's system produces *intermittent or continuous* flow with only surface adjustment. It is a simple, functional system both in installation and operation.

Guiberson CONTROLLERS, made in a variety of types and sizes, have the exclusive timer drum that lets you change settings in seconds. Guiberson FLOW VALVES in five types have built-in reliability.. have tough, long-lasting tungsten carbide ball and seat.. are tested and proved perfect before shipping. Guiberson MANDRELS are provided in many types.. standard or special. Guiberson CHECK VALVES come in two types.. spring loaded or velocity.

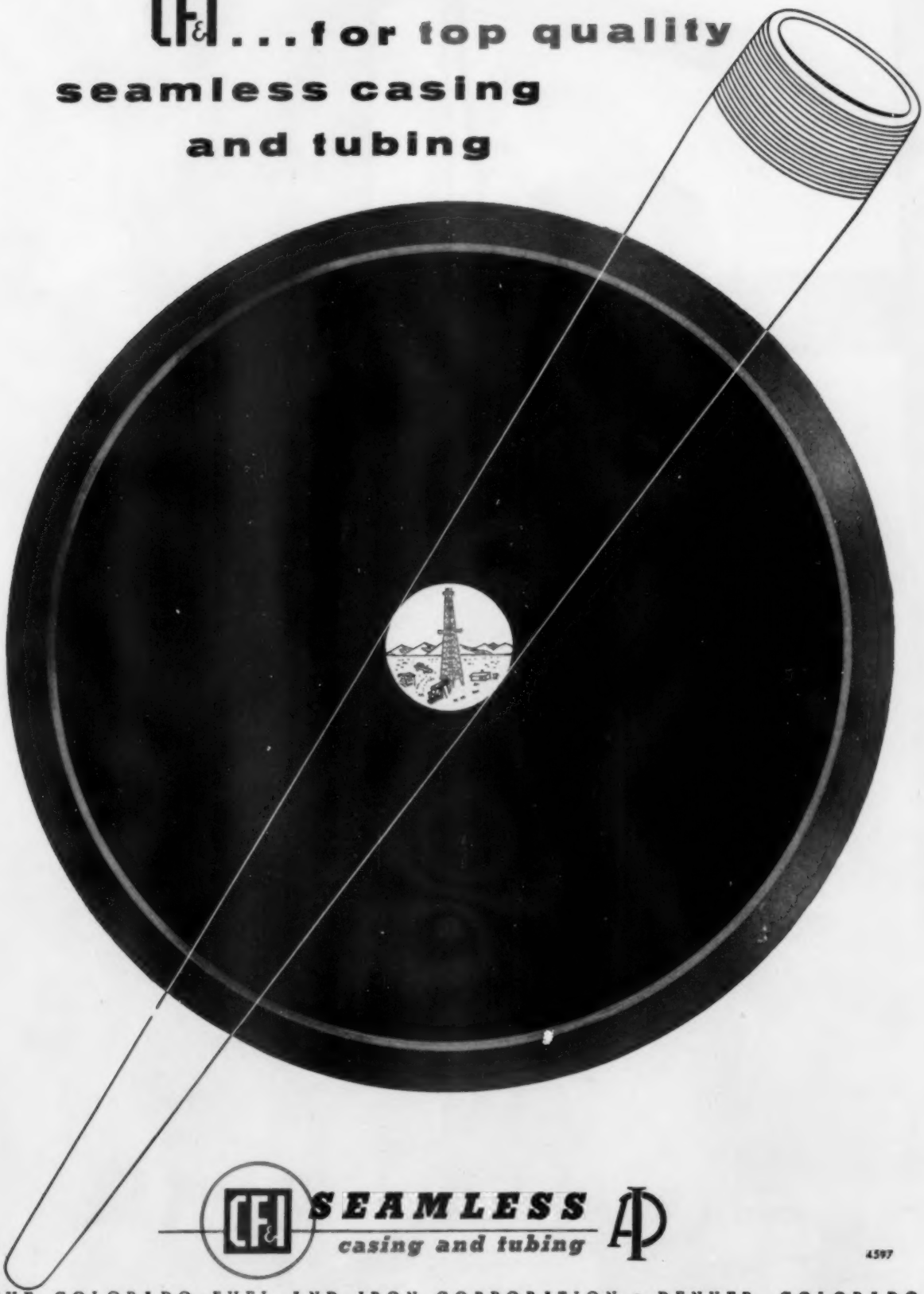
Let Guiberson engineers advise you about gas lift for your production. If your wells are producing fluid, if sufficient gas volume and pressure are available, we will design an attractively priced gas lift system, including compressor equipment, tailored to your needs.

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.

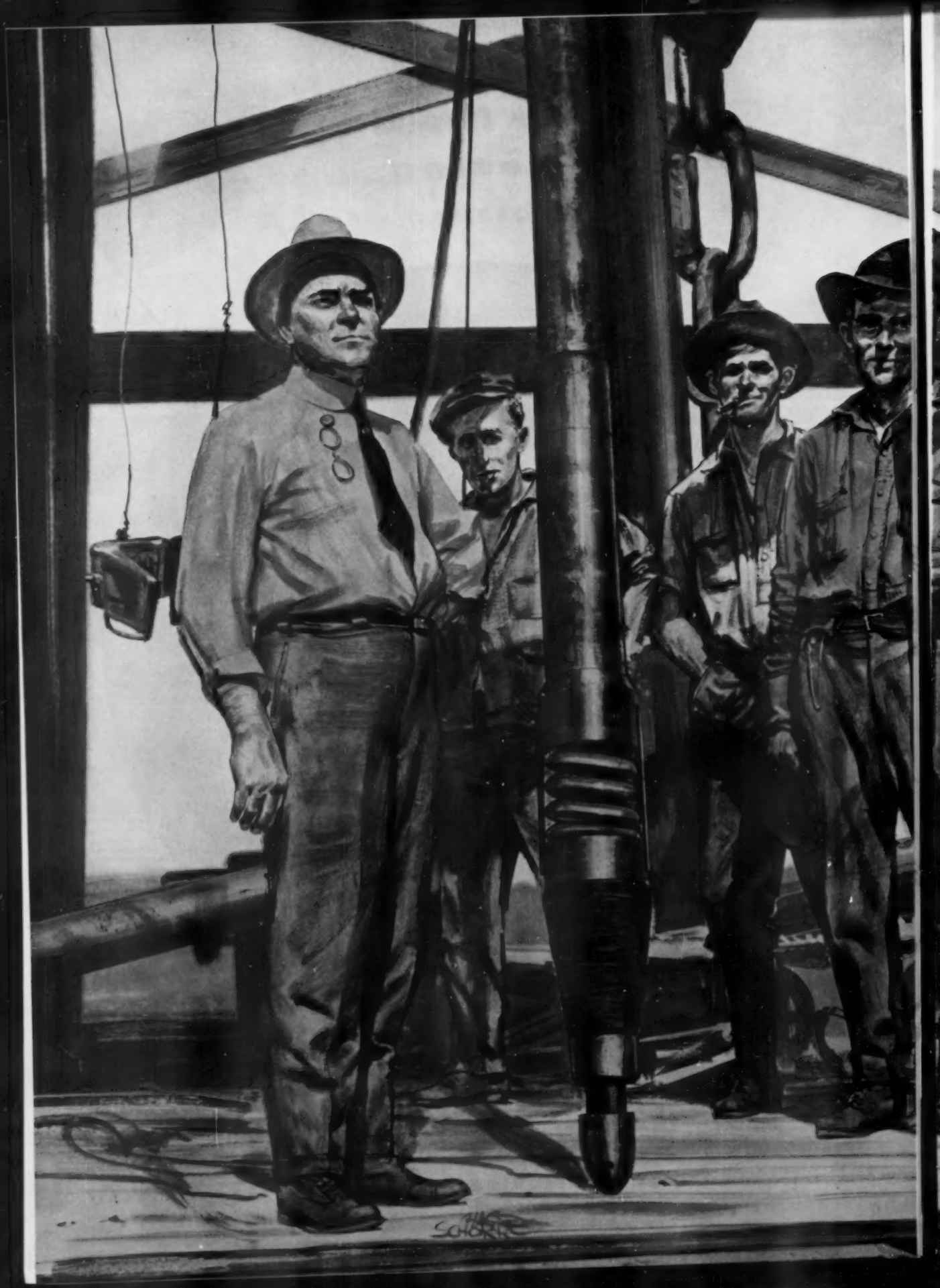
CF&I . . . for top quality seamless casing and tubing

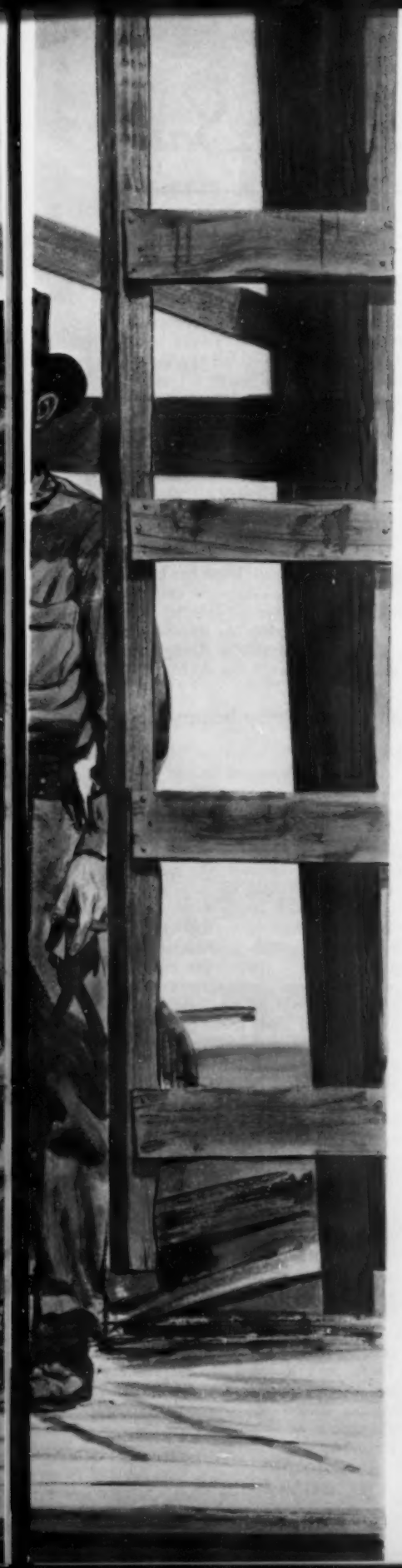


CF&I SEAMLESS casing and tubing AP

4597

THE COLORADO FUEL AND IRON CORPORATION • DENVER, COLORADO


SCHORR



JUST OVER THIRTY YEARS AGO

El Dorado, Arkansas was booming. In progress was a drilling program, the size of which had seldom been seen until that time. More than an oil discovery was made at El Dorado for it was during that boom that the first Johnston Drill Stem Test was run. Since then, more than thirty years ago, over half a million drill stem tests have been run by Johnston personnel and with Johnston equipment.

No other similar service organization has accumulated such a wealth of experience.

A great number of problems had to be overcome in the early days of drill stem testing . . . equipment, test evaluation, and industry acceptance. The problems were overcome and drill stem testing was recognized as one of the most important precasing informational services available.

From the first, Johnston devoted practically all of its research and development effort to a single objective . . . the improvement of the testing tool design. With the best designed and workable equipment Johnston then perfected evaluation techniques.

Through the last thirty years Johnston has gained the priceless ingredient of real success . . . experience. There's no way of knowing just how many strings of pipe have been saved or the number of fields discovered since the Johnston brothers invented their first drill stem testing tool. All agree, however, that the industry has benefited greatly from Johnston's thirty years experience. Johnston equipment, methods, and personnel lead the field.

Remember that all drill stem tests are not alike . . . that Johnston will give you the best results, year in and year out.

Always call Johnston and be sure.

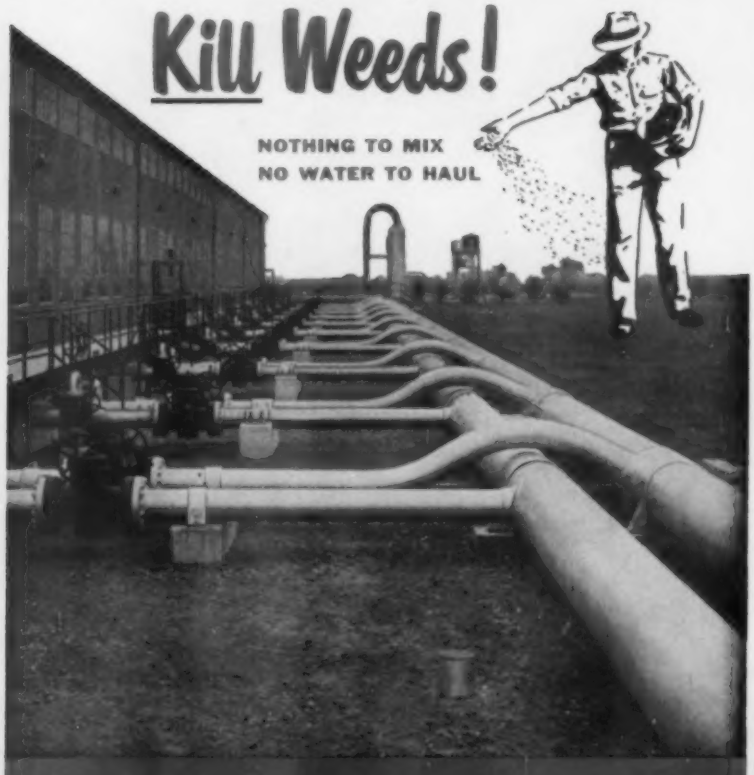
Johnston Testers, Inc., Houston, Texas; Long Beach, California; Calgary, Alberta, Canada.

A World Of Experience

JOHNSTON TESTERS

Here's the easy way to

Kill Weeds!



CONCENTRATED

BORASCU® WEED KILLER

.....prevents regrowth—one application may keep area clear of weeds and grasses for 1 or 2 years!

This weed killer gives lasting control of fire-hazardous vegetation... and that's what you need in the Petroleum Industry. Low cost, easy application, safety and convenient packaging are other important features you get with Concentrated BORASCU. Use it anywhere, in any climate, to destroy weeds. Concentrated BORASCU is nonpoisonous, nonflammable, and noncorrosive to ferrous metals... try it!

WRITE FOR DETAILS!

United States Borax & Chemical Corporation

PACIFIC COAST BORAX COMPANY DIVISION

630 SHATTO PLACE • LOS ANGELES 5, CALIFORNIA

DISTRIBUTORS LOCATED THROUGHOUT OIL FIELDS OF U.S.A., CANADA, MEXICO, COLOMBIA, VENEZUELA.

They Say-

Coddling at Shell's school?

Dear Sir:

The article "Shell Runs Academy for its Managers" in the February 10, 1958, issue, page 70, points up the sharp contrast between present-day managers and the great oil men of the past, like Bill Skelly and Harry Sinclair.

On the check list given to spot weaknesses (page 71) over 50 per cent of the items stress group conformity and coddling. For example: "Item D3: Get group reaction on important matters before going ahead."

Leadership, on the other hand, is not even mentioned. What has become of that individualistic spirit of leadership that made the oil industry great?

Enders A. Robinson
Consulting Geophysicist
East Lansing, Mich.

Retire and stay happy

Dear Sir:

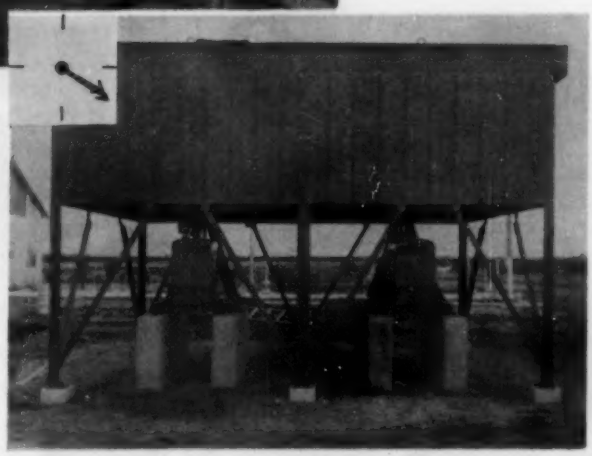
Seeing the pictures caused me to read the article in the February 3 Oil and Gas Journal entitled "How Retirement Plans are Working." It confirms my conclusion that an oil-company employe is about the most self-centered individual in any industry in America.

As an independent producer nearing the age when oil-company employes retire, I don't ever expect to retire. Yet I am gradually turning over more and more of my former duties to others so that I can have more and more fun in those things grouped under the very general term of "community service."

As an oil-company employe, I was just as selfish as anyone—never living in one place for very long and never taking any interest in the civic life of the community in which I was stationed. When I did get out for myself, I was then eligible to be loaned a classification in Rotary. Then, for the first time, I realized there were others in the world besides myself. And it was great fun to work with the others for the common good of all.

There are so many youth activities needing the services of adult advisers. There isn't a town in the country which isn't helped by the citizens committees formed of technical experts of various sorts . . . He is doubly fortunate who can have the benefit

7 hours 20 minutes



This Smithco process cooling unit was completely installed and ready to operate in less than eight hours.

Through precise planning and engineering skill, time and money saving operations such as this are standard at Smithco. Two major reasons for such speedy installations are: TEST ERECTION — Each unit is completely assembled and disassembled in the plant as a final check before it is approved and released. PREFABRICATION — The units are composed of large easy to handle sections which are completely welded for strength and rigidity.

Test Erection and Prefabrication are just two of the many reasons why the Smithco name is rapidly becoming synonymous with quality products.

It's a Smithco . . . Your Guarantee of Quality

Plant and Offices — Tulsa, Oklahoma
P. O. Box 3217

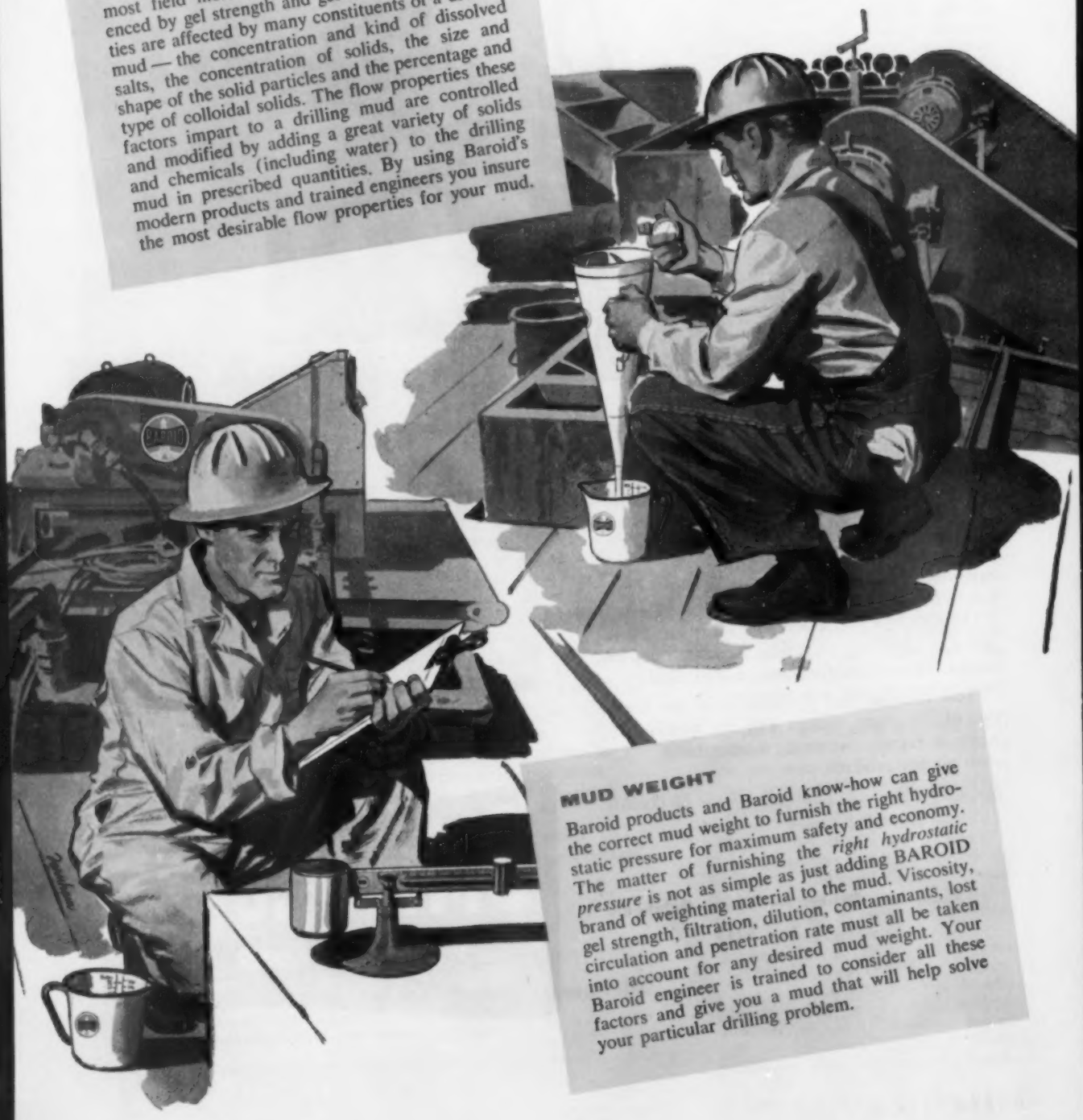
SMITHCO
Engineering Inc.

Seeing is believing...

BAROID mud

FLOW PROPERTIES

Viscosity is a measurement of flow properties and most field measurements of viscosity are influenced by gel strength and gel rate. These properties are affected by many constituents of a drilling mud — the concentration and kind of dissolved salts, the concentration of solids, the size and shape of the solid particles and the percentage and type of colloidal solids. The flow properties these factors impart to a drilling mud are controlled and modified by adding a great variety of solids and chemicals (including water) to the drilling mud in prescribed quantities. By using Baroid's modern products and trained engineers you insure the most desirable flow properties for your mud.



MUD WEIGHT

Baroid products and Baroid know-how can give the correct mud weight to furnish the right hydrostatic pressure for maximum safety and economy. The matter of furnishing the *right hydrostatic pressure* is not as simple as just adding BAROID brand of weighting material to the mud. Viscosity, gel strength, filtration, dilution, contaminants, lost circulation and penetration rate must all be taken into account for any desired mud weight. Your Baroid engineer is trained to consider all these factors and give you a mud that will help solve your particular drilling problem.

gives you the answer to basic drilling problems

FILTRATION

Baroid's competent men, up-to-date techniques and engineered products can keep the filtration properties of your mud best for the job. Filtration properties determine the thickness and character of the filter cake deposited on the wall of the hole and the volume and character of the fluid that is lost into the formation. An optimum cake thickness, filtrate volume, and filtrate character can prevent stuck drill pipe, caving shale, tight hole, and contribute to satisfactory casing and cement jobs as well as money making completions.

. . . by the control of basic mud properties

Baroid engineers are ready, willing and trained to control every mud property. Proper control of mud properties solves many of your basic drilling problems. This means faster, deeper, trouble free, less costly drilling and better completions — a successful operation.

Use Baroid's greater skill, experience and complete line of products to assure successful drilling. Your Baroid engineer can help you plan and carry out a complete program or meet any mud emergency. He can also show *what* products to use, and *why* and *how* they do the job right. Seeing is believing.

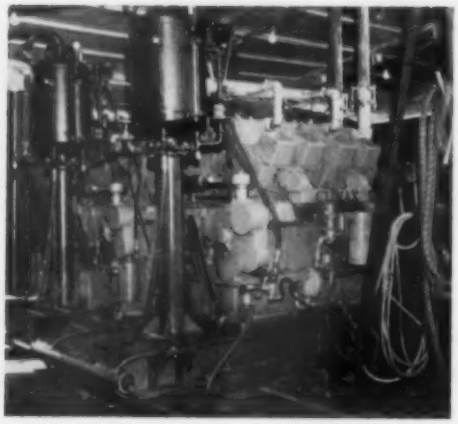
BAROID

BAROID

BAROID DIVISION ● NATIONAL LEAD CO.
Main Office: P. O. Box 1675, Houston 1, Texas

B 5809

VAPOR PHASE® ELIMINATES RADIATORS, FANS, WATER PUMPS ON DRILLING ENGINES

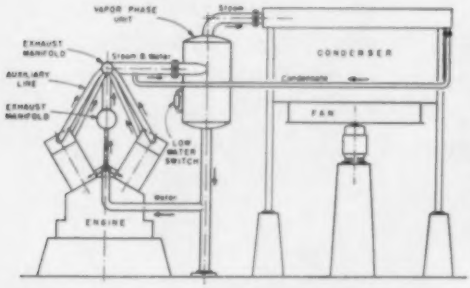


High Temperature Cooling Increases Horsepower; Reduces Fuel, Lube, & Maintenance Costs

Rig No. 1 of Choya Drilling Co., Inc. has increased engine horsepower by nearly 20% at an approximate cost of $6 per bhp., by installing a Vapor Phase cooling system.

WEST Texas' first Vapor Phase cooled rotary rig is in operation at Midland, Texas, headquarters for the Choya Drilling Co., Inc.

In addition to doing away with many of the items essential to conventional drilling engine cooling systems, the Company has increased the power of the rig's two main engines from 265 to 325 hp., while still operating at the same manifold pressures. It is no longer necessary to change radiator cores frequently, or de-scale engine jackets, since the Vapor Phase system is a **closed** system, requiring no make-up water.



Engine jackets are flooded with water at boiling temperature: steam and water go to separator; steam to portable condenser (skids not shown). Condensate is drained to hot well, and returned to Vapor Phase system by a pump to maintain proper liquid level.

"Sole Developers and Manufacturers of Vapor Phase® Thermal Circulation (Ebullition) Engine Cooling Systems"

E C VAPOR PHASE

ENGINEERING CONTROLS Inc.

An Affiliate of St. Louis Shipbuilding & Steel Co.

611 E. Marceau St. St. Louis 11, Mo.

1939 N. Hillhurst Ave. Los Angeles 27, Calif.

of membership in a service club—even in a civic club. This whole matter of service above self is a subject upon which Mr. Self didn't even touch.

Mr. Self indicates that, for the most part, retired oil-company employes have no financial worries, own their own homes fully paid out, and are otherwise in good shape except for something to do.

Trying to retain association in some form or another with the company is no deal, for younger men are coming up all the time and there is less and less in common. A certain amount of recreation is a must. But after that I can tell anyone from my own personal experience that there is so much they can do in the category of community service that they could keep more than busy and plenty happy from now until doomsday and still never get done all they would like to do. And while it is preferable to begin on these things while still young, there is a place for you at any time in life.

I am satisfied from my own experience that the fault lies with the management of the companies. If management would meet the employe half way in time and out-of-pocket expenses, and encourage community service and trade-association work they would more than make up for it in improved public relations. "He profits most who serves best."

Frank Gouin
Geologist
Duncan, Okla.

Import plan helps foreign oil

Dear Sir:

I believe you could do much good to the industry if you would bring out a paragraph in one of your editorials calling attention to the following.

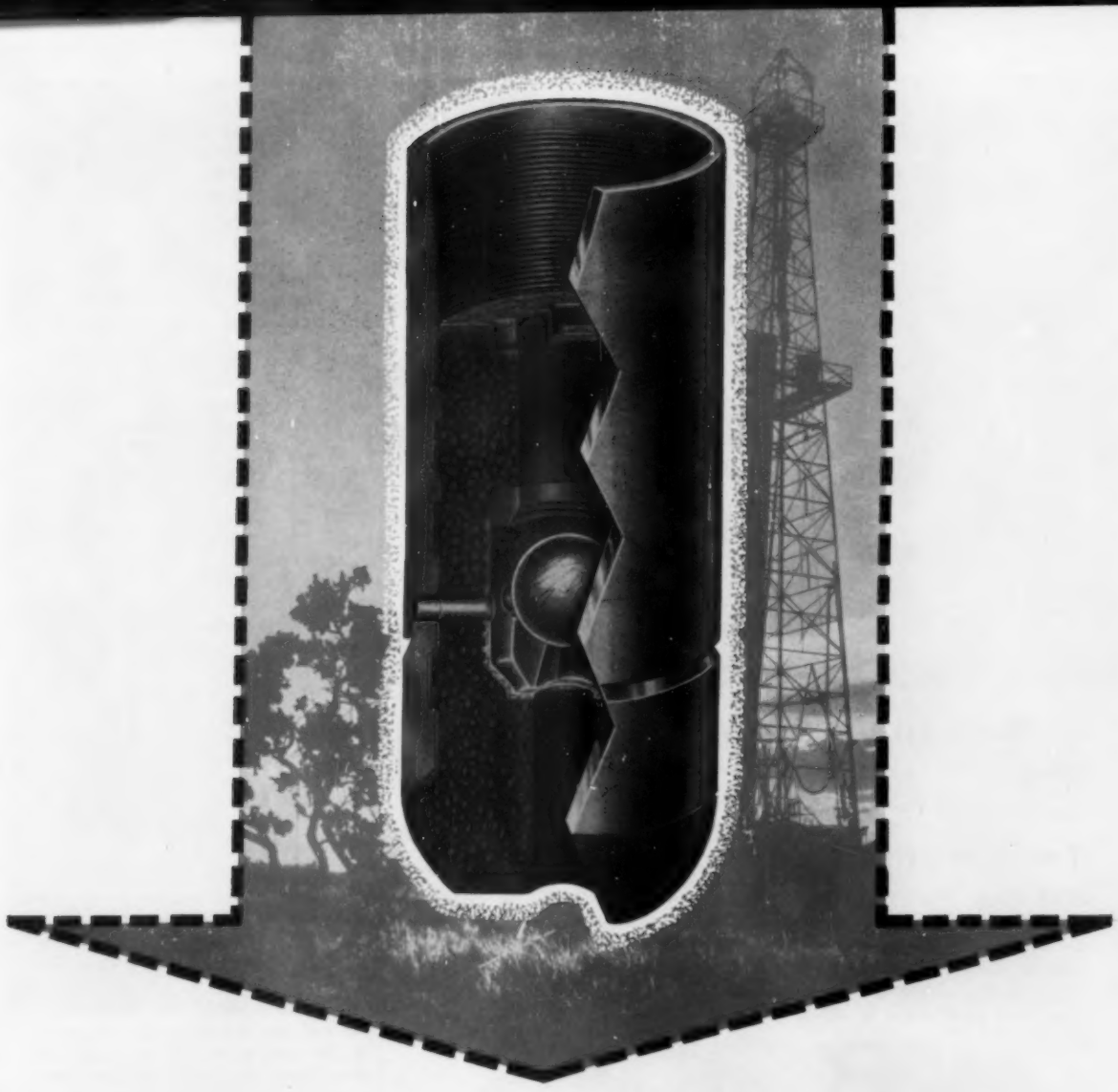
First, as we all know, a number of foreign countries from which we import oil have been disturbed because we are trying to slow up imports.

Second, I have not noticed any of the U.S. foreign producers educating the foreign country that we are really protecting them by this action.

If imports were brought in at an increasing flood rate the price of our oil and their oil would suffer. If we did bring in unlimited oil like they want we could not hold the price and they would lose much of their asset at a very low price.

Actually we are protecting their resources by bringing in oil at amounts that will hold and steady the price so that they will get as much as possible for their oil.

I believe you could do a great



Larkin Leads the Way

in guiding and floating equipment

The preponderant use of Larkin Floating and Guiding Equipment is a natural result of its years of dependable performance.

Experience brings confidence—and that's why thousands upon thousands of wells each year are cemented through Larkin Equipment.

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

LARKIN
...Through Your Supply Store

PESA

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

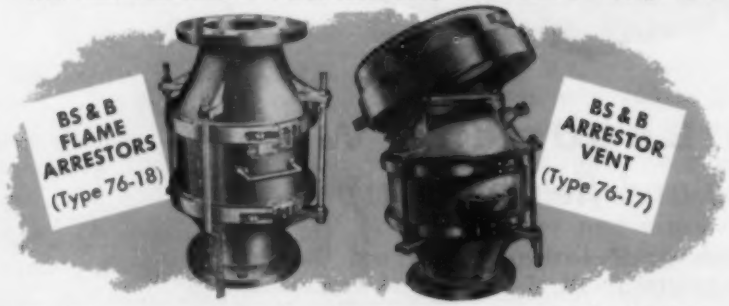
SUREST PROTECTION
for Volatile Liquids in Storage

Safeguard Your Tanks with

BS&B *Lightweight*

Tank Vents and Flame Arrestors

BS&B TANK VENT (Type 76-16) shown above features floating seal for positive shut-off under both pressure and vacuum, without using the weight of the hinged cover. Vapor pressure within the tank (or atmospheric pressure in the case of vacuum) maintains seal. Cover and major internal components are aluminum with stainless and plated steel hardware. Plastic coated bases are cast iron. These vents mount to 125-lb. ASA bolting circles. Sizes 6" through 12".



For free vent systems. May be mounted either horizontally or vertically. End connections are 125-lb. ASA flanged for mounting to open vent lines of process vessels. Flame-bank end flanges are identical to those of the Type 76-17 Arrestor Vent bases (at right). Light weight, maximum venting capacity and servicing ease are important features of the Flame Arrestor.

Combines the features of the other two types described here. Functions both as a tank breather and a cartridge-type flame arrestor to prevent ignited vapors from flashing back into the tank. Flame bank is secured by two quick-opening V-clamps for easy access to unit for inspection and servicing. Normal venting with the flame bank removed is maintained by simply securing the top unit to the base with one V-clamp. Internals of flame bank are alternate layers of flat and corrugated aluminum strips, in a continuous roll.

Ask your BS&B representative for Catalog 76-16 or write . . .

BS&B

BLACK, SIVALLS & BRYSON, INC.

Safety Head — Vent Valve Division, Dept. 2-A3.
7500 East 12th Street • Kansas City, Missouri

service to our companies and foreign prestige if you would get this thought in print so that our companies could help to educate the foreign countries in this economic fact.

Dale E. Lambert
Rock Island, Ill.

Big firm uses small suppliers

"Our purchases illustrate a fact that is often overlooked: Du Pont, like most big companies, depends on small suppliers to keep its plants running. Of the 30,000 companies Du Pont buys from, more than 90 per cent are small concerns with less than 500 employes.

"A good many of them have increased their own business and grown. Not at all unusual is the one-man operation started several years ago to make filter cloths for a single customer—a Du Pont plant—and which now employs half a dozen workers and sells these cloths to several other customers as well.

"Big companies find they must rely often on the flexibility of the small supplier or service establishment to keep their production lines on schedule. Big and small companies are interdependent."

T. C. Davis, Du Pont vice president and adviser on purchases, in a statement to the press.

Low point passed?

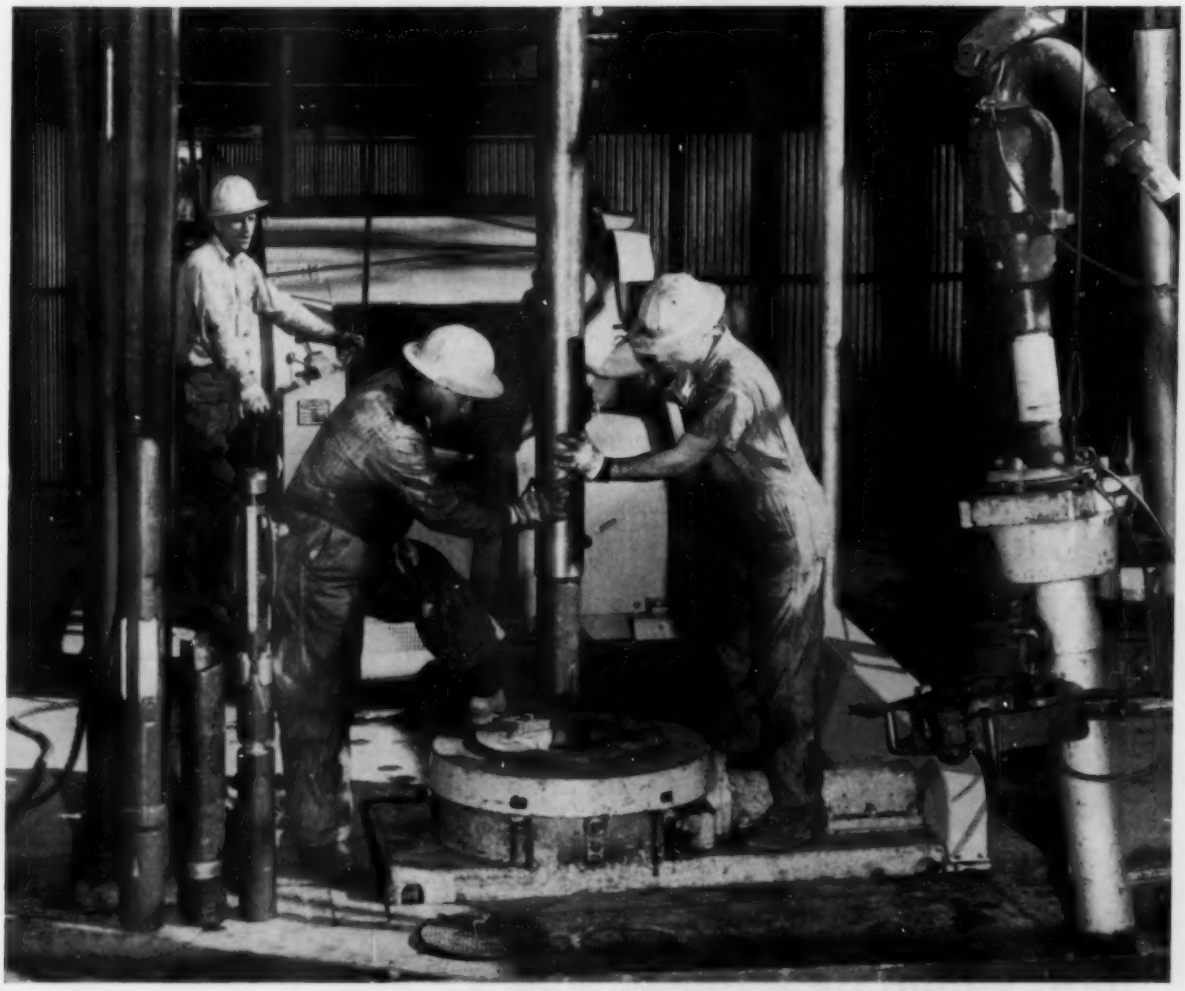
"It is our belief that the domestic oil and gas industry's operations are at the low point of the year, and that, from this point forward, moderate expansion in activity should take place."

R. E. Reimer, executive vice president, Dresser Industries, Inc.

CALENDAR OF EVENTS

MARCH

- **3-4** Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, fourth annual joint meeting of Rocky Mountain petroleum sections, Cosmopolitan Hotel, Denver.
- **5-6** Gas Conditioning conference, sponsored by the University of Oklahoma, Oklahoma Memorial Union Building, Norman, Okla.
- **7** Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.
- **7-8** American Association of Petroleum Geologists, Pacific Coast section, annual meeting, Ambassador Hotel, Los Angeles.



A view of the facilities at Brown Oil Tools' test well. Here, each new tool is tested under realistic conditions before being put to use in the field.

Here's why more operators are relying on Brown Oil Tools' Service Division

Well engineered, quality fishing tools in the hands of a good fishing tool man . . . this is the type of service you get from Brown's Service Division. And, over the years, Brown has continued to get the best results.

Brown's operators are specialists, recognized for their years of experience, fishing operation skill and know-how, full knowledge of fishing tools . . . and when to use them.

The excellence of Brown fishing tools is well recognized. And, since the construction of the Brown test well, you are assured of a proven tool. Each new tool or component is given a thorough test under tough, realistic, downhole conditions.

It's no wonder Brown Service is demanded more and more. You'll find, as others have, that you can't go wrong with a Brown serviceman on your next job.

Contact your nearest Brown Oil Tools service representative for the best results. You'll find one in all active oil centers.

BOT BROWN OIL TOOLS, INC.

8490 Katy Road, Houston, Texas

All Brown tools and service equipment are sold for export.

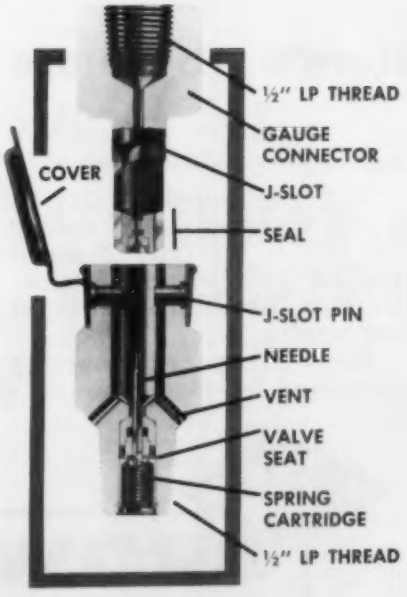
whoever thought there would be a better way to gauge well pressures!

Permanently installed Christmas tree gauges are an unnecessary capital investment and maintenance expense. Furthermore, they are subject to vandalism and accidental breakage. Constant exposure to the elements can affect gauge accuracy, resulting in incorrect pressure readings.

There's a new and better way to gauge well pressures. The TC Gauge Valve and Connector permits the operator to gauge dozens of wells with a single pressure gauge. Only the Gauge Valve element is installed permanently on the tree, and a single master gauge is carried from well to well to obtain the pressure readings.

Note in the cutaway view of the TC Gauge Valve and Connector at right how the Connector Element, to which the master gauge is attached, engages a J-slot in the Gauge Valve Element, opening a spring-actuated valve to expose the gauge to well pressure. The operation requires only a minute or two.

Complete details on this money-saving, more efficient well gauging method will gladly be sent on request.



THORNHILL UNIBOLT **CRAVER CO.**

P. O. BOX 1184 HOUSTON, TEXAS

10-13 American Association of Petroleum Geologists and Society of Economic Paleontologists and Mineralogists, forty-third annual meeting, Biltmore Hotel, Los Angeles.

12-14 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Texas, Fort Worth.

13-14 Fifth annual Heat Transfer Conference, Oklahoma State University, Stillwater, Okla.

17-21 International Atomic Exposition, Inc., 1958 Nuclear Congress, Chicago Amphitheatre, Chicago.

17-21 National Association of Corrosion Engineers, annual conference, civic auditorium, San Francisco.

20-21 New England Gas Association, annual meeting, Hotel Statler, Boston.

20-21 Society of Petroleum Engineers of American Institute of Mining, Metallurgical, and Petroleum Engineers, regional conference on production and reservoir engineering, Mayo Hotel, Tulsa.

24-26 Midwest Gas Association, Broadmoor Hotel, Colorado Springs, Colo.

24-26 Western Petroleum Refiners Association, annual meeting, Hilton Hotel, San Antonio, Tex.

26 Petroleum Equipment Suppliers Association, southwestern district meeting, Shamrock-Hilton Hotel, Houston.

27-29 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Southwest conference, St. Francis Hotel, San Francisco.

29 North Texas Oil and Gas Association, annual meeting, Kemp Hotel, Wichita Falls, Tex.

23-30 Mexican Association of Petroleum Geologists, Mexico City.

31-April 2 American Petroleum Institute, Division of Transportation, annual pipeline conference, Jung Hotel, New Orleans.

31-April 2 American Institute of Electrical Engineers, southwest district meeting, Mayo Hotel, Tulsa.

APRIL

1-3 University of Oklahoma, fifth annual conference on corrosion control, Extension Study Center, Norman, Okla.

2 Petroleum Equipment Suppliers Association, eastern district meeting, Duquesne Club, Pittsburgh.

8 American Institute of Chemical Engineers, Philadelphia-Wilmington section, University of Pennsylvania, annual meeting, University of Pennsylvania campus, Philadelphia.

9-11 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Biltmore Hotel, Oklahoma City.

13-18 American Chemical Society, national meeting, San Francisco.

15-17 University of Oklahoma, thirty-fourth annual gas measurement short course, North Campus, Norman, Okla.

16-18 Natural Gasoline Association of America, annual convention, Baker and Adolphus Hotels, Dallas.

16-18 National Petroleum Association, fifty-fifth semiannual meeting, Hotel Cleveland, Cleveland.

17 Petroleum Equipment Suppliers Association, Pacific district meeting, Beverly-Hilton Hotel, Los Angeles.

17-18 Texas Technological College, fifth annual West Texas oil lifting short course, Lubbock, Tex.

17-18 American Institute of Mining, Metallurgical, and Petroleum Engineers, Louisiana-Arkansas, East Texas, and Mississippi petroleum sections, gas technology symposium, Shreveport, La.

17-18 Geophysical Society of Tulsa, Tulsa Geological Society, annual midwestern exploration meeting, Tulsa.

17-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest regional conference, Spokane, Wash.

20-23 American Institute of Chemical Engineers and Chemical Institute of Canada, chemical engineering division; Canada-U.S. chemical engineering conference, Montreal.

21-23 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Cosmopolitan Hotel, Denver.

23-25 Second International Williston Basin Symposium, sponsored by Saskatchewan Geological Society and North Dakota Geological Society, Regina.

27-30 American Association of Petroleum Geologists, Rocky Mountain section, Casper, Wyo.

28-29 University of Oklahoma, third annual conference on automatic control in the petroleum and chemical industries, Oklahoma Memorial Union Building, Norman, Okla.

28-29 Independent Petroleum Association of America, mid-year meeting, Sherman Hotel, Chicago.

28-30 Southern Gas Association, annual convention, Dallas.

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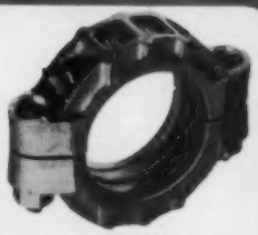

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GUSTIN-BACON Manufacturing Company

210 W. 10th St. Kansas City, Mo.

29-May 1 Petroleum Industry Electrical Association, Petroleum Electric Supply Association, annual joint meeting, Adolphus Hotel, Dallas.

MAY

5-6 Society of Petroleum Engineers of AIME, North Texas section, secondary-recovery symposium, Wichita Falls, Tex.

5-7 Purdue University, thirteenth annual industrial waste conference, Purdue Memorial Union Building, Lafayette, Ind.

5-9 American Gas Association, distribution, production, and transmission conference, Roosevelt and Commodore Hotels, New York.

7-9 American Petroleum Institute, Division of Production, eastern district meeting, Deshler-Hilton Hotel, Columbus, Ohio.

8-9 Texas Petroleum Research Committee, eleventh oil recovery conference, symposium on "A Century of Texas Oil, 1875-1975," University of Texas, Austin.

11-14 Texas Independent Producers and Royalty Owners Association, annual membership meeting, San Antonio, Tex.

12-14 Chemical Institute of Canada, National Research Council, eighth Canadian high polymer forum, Macdonald College, St. Anne de Bellevue, Quebec.

12-14 Instrument Society of America, symposium of analysis instrumentation division, Shamrock Hilton Hotel, Houston.

12-15 American Petroleum Institute, Division of Refining, midyear meeting, Statler Hotel, Los Angeles.

20-22 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

21-23 Rocky Mountain Oil and Gas Association, thirteenth annual convention, Cosmopolitan Hotel, Denver.

21-23 American Petroleum Institute, Division of Marketing, midyear meeting, Roosevelt Hotel, New Orleans.

22-23 American Petroleum Institue, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

26-28 Chemical Institute of Canada, annual conference and exhibition, Royal York Hotel, Toronto.

JUNE

2-4 Petroleum Electric Power Association annual meeting Texas Hotel, Fort Worth.

5-7 National Oil Scouts and Landmen's Association, annual meeting, Mayo Hotel, Tulsa.

8-11 American Petroleum Institute, Division of Transportation, annual tanker conference, Greenbrier Hotel, White Sulphur Springs, W. Va.

10-12 Appalachian Underground Corrosion Short Course, School of Mines, West Virginia University, Morgantown, W. Va.

19 Pennsylvania Grade Crude Oil Association, annual meeting, Penhills Club, Bradford, Pa.

23-25 Interstate Oil Compact Commission, midyear meeting, Hotel Utah, Salt Lake City.

22-28 American Society for Testing Materials, annual meeting and exhibit, Hotel Statler, Boston.

28-July 2 Petroleum Equipment Suppliers Association, twenty-third annual meeting, Chateau Frontenac, Quebec.

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58—102

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the OIL AND GAS JOURNAL

TULSA, OKLAHOMA

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JOURNALLY SPEAKING

Forecasting With Oscar

IT CAN NOW be told. The Venezuelan revolution was predictable weeks ahead of time.

Key to this strange fact lies with a member of our own staff. He's Oscar B. Irizarry, publisher of the Journal's sister publication, Petroleo Interamericano. Oscar has been called "a crystal ball of catastrophe"—not because he foretells the future, but because he makes things happen.

For example, Oscar left Tulsa to visit Venezuela in 1947. He arrived in Miami, Fla., just in time to greet one of the worst hurricanes in years. It killed more than 100 people.

Not long after that Oscar toured Mexico's oil fields. While bunking in a field camp during a torrential rain, Oscar was stabbed by a king-size scorpion which crawled into bed to get out of the storm. He was deathly ill — with his tongue paralyzed—for 3 days.

On another trip to Venezuela he checked into a new hotel just in time to get his laundry into a batch with too much bleach. The bleach dissolved all laundry marks—dissolved most underwear, in fact—and turned all socks the same color. The hundreds of hotel guests had to march to the main ballroom and try to identify and recover their belongings out of a mountainous pile of miscellaneous clothing.

It should have been plain to anyone that when Oscar announced he was going to Venezuela again, something big was going to happen. Coupled with press reports of a growing dissatisfaction with Perez Jimenez, his plans should have tipped us off to the imminent revolution. But nobody put two and Oscar together.

His arrival in Caracas was typical. Nobody was leaving, the hotels were full, and only after much discussion was he put in the Tamanaco's presidential suite. This worried Oscar more than the revolution. In normally high-priced Caracas, he was unnerved by the probable cost of a spacious, beautifully appointed suite which had, besides art treasures, gold doorknobs and gold faucets.

Oscar encountered the revolutionists the next day. He was caught in a riot near the petroleum ministry and immediately became the central attraction. But an anti-P.J. friend identified him and rescued him.

Oscar is convinced there's nothing really unusual about his trips—or the things that happen. "These things happen to other people; they just don't tell about them," he insists. But other staffers have visited countries all over the world without fainting while looking into an active volcano, having their pocket picked, or getting caught in a revolution.

OSCAR in Venezuela . . . with Williams Brothers Pilot Andrew Lockhart.

There's one remarkable thing about Oscar. He overcomes his difficulties. He learned much about Lake Maracaibo's new "Golden Lane," got a good line on future policies of the new Venezuelan Government, and picked up some interesting impressions about the world's second largest producing country. All of this is neatly packaged for you, beginning on page 66.

There Are Still Records

The biggest advertisement ever run in the Big Yellow Book appears in this issue. It's a 24-page ad prepared by Ford Motor Co. to give detailed design and operating information on the company's heavy-duty trucks.

The whole section, which starts on page 141, is for those men who buy heavy equipment and who have to know what they're getting. Incidentally, and we're proud to say so, you won't find this ad in any other magazine serving drilling, production, refining, or pipeline people.

—Ted Armstrong.

there's something new in Packers!

Where there is a need... Baker shows the way. Recognizing a need for an economical, retrievable and yet dependable packer for water flooding and other pressuring applications in shallow or low fluid wells, Baker engineers have come up with the new Model "A" Tension Packer.

Compact design makes the big difference in this new packer. Imagine the ease of shipping, storing and handling a packer less than 30″ long. Its size is deceptive, for it contains many field-tested features of Baker retrievable squeeze tools.

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Get to know the Model "A" better. There *is* something new in packers, and your Baker man has all the facts. Call him for information on how the Baker Model "A" Tension Packer can solve *your* hook-wall packer needs, or write for Bulletin No. 334.

PRODUCT NO. 739-A

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HOUSTON • LOS ANGELES • NEW YORK

MODEL "A"
TENSION PACKER

Let's have a showdown on the Harris gas bill

THE defeatist attitude toward the Harris bill that has numbed the industry since the Jack Porter incident is playing straight into the hands of the bill's opponents.

The bill is suffering more from its alleged friends than from its enemies. It should be brought to a vote this session to make people stand up and be counted.

The Porter letter was an unfortunate blunder and cannot be defended. But it was magnified out of all proportions by the unctious attitude and political timidity of the White House and GOP leaders.

IT SEEMS OBVIOUS that Republican leaders were looking for any excuse to welsh on their pledges to support legislation to free industry from bureaucratic regulation.

It was the bill's enemies who spread the word that the incident makes passage impossible. The bill's congressional friends must be shown that this is a smoke screen to prevent consideration on its merits.

The Harris bill could be passed with strong White House support. The Republicans should be forced to take a stand on whether they really like the principle of the bill more than they dislike the tactics of a few of its supporters.

Getting right down to practical politics, Republicans should be reminded that their party carried most of the normally Democratic gas-producing states in the last two elections, and that this was due in large measure to their stand for legislation to promote free enterprise in general and the gas bill in particular.

Gas producers should demand that Republicans demonstrate whether they will stand on their platforms and pledges or continue to defeat the bill by hypocritically dodging behind some side issues.

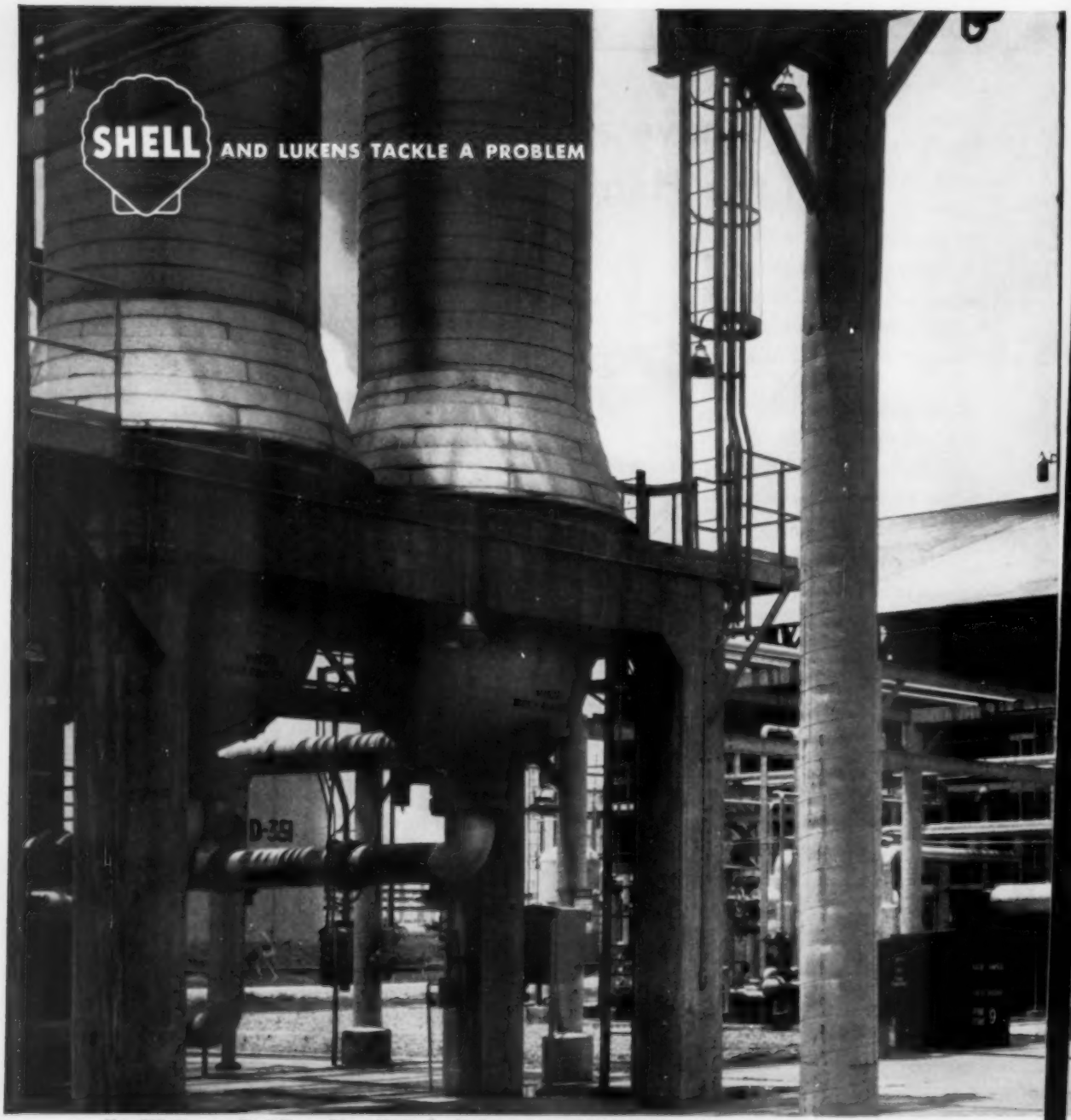
SUCH POLITICAL double-talk must be ended. Let's have a showdown. The bill can be passed if considered on its merits.

If those who say it has merit—including the White House—will concede that the Porter incident was only an unfortunate flyspeck it will get Democratic supporters off the hook and give them the courage of their convictions to vote for it.

If defeated on a roll call, the bill will be dead for this Congress but the industry will know whom to blame. But it will be even deader if it is timidly pigeonholed because its enemies capitalized on a political booboo by one of its friends.

Every political battle develops things like the Porter incident, and if such are allowed to obscure the real issues there will never be any legislation.

Bring the bill to a vote. It's better to go down fighting for a cause than to be scared off the battlefield by bluffs and bugaboos.



Two 78" diameter Shell Vapor-Phase Hydrodesulfurizer reactors fabricated with Lukens stainless-clad steel.

Teamwork pays off—designing desulfurizers and

Flued hemispherical heads answer need for uniform stress patterns

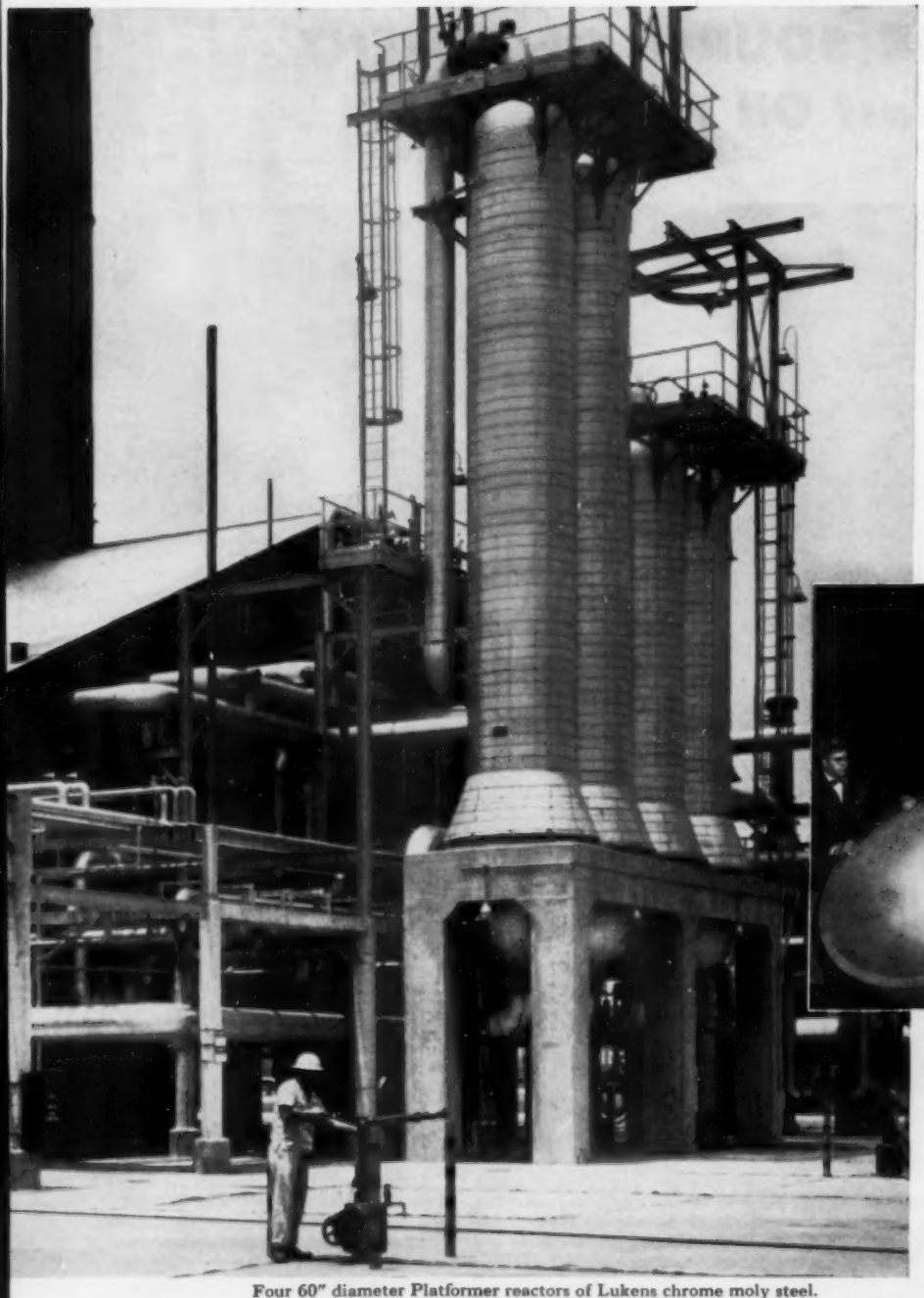
It took teamwork between Lukens and Shell . . . and at this modern Houston, Texas, refinery the results are rewarding.

There were separate problems in selecting steels for the Shell V-P Hydrodesulfurizers and Platformers and a common problem of obtaining a more uniform stress pattern in heads of both.

In the 78" diameter V-P Hydrodesulfurizer reactors, Lukens stainless-clad steel with a backing of Lukens A-204 firebox steel provided the required high resistance to hydrogen and hydrogen sulfide attack at elevated temperatures, plus strength and protection against hydrogen embrittlement.

In the 60" diameter Platformer reactors, where design pressure is 800 psi and design temperature is 950 deg. F., Lukens chrome moly steel plate gave still greater strength-temperature handling ability, plus resistance to hydrogen attack.

And by the use of Lukens hemispherical spun and flued heads in both the V-P Hydrodesulfurizer and the Platformer, engineers and production men



Four 60" diameter Platformer reactors of Lukens chrome moly steel.

Visit us at the

N.A.C.E.

Show in San Francisco, March 18 through 20. Our booth number is 35-37.

Smooth contours and accurate location of the flued openings in these Lukens spun heads matched Shell's critical design needs.

reformers with Lukens clad and alloy steels

achieved an outstanding advantage: Uniform stress patterns in the critical flued areas with added assurance of maintenance-free operation at high temperatures and pressures.

Ask your equipment builders about the broad range of Lukens clad, alloy, and carbon steels, or write for "CLAD STEEL EQUIPMENT." Address Manager, Marketing Service, Room 123, Lukens Steel Company, Coatesville, Pa.

This is Lukens clad steel—a solid plate—one side corrosion resistant metal permanently bonded over-all to a rugged, economical backing steel.

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Helping industry choose steels that fit the job

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Select Cement to Fit the Job!

Lone Star's New Lake Charles, La., Plant ideally Located to Serve Oil Industry Needs

An ever-ready supply of the right cement for each oil-well job is absolutely essential.

Lone Star's proved performance cements help to protect oil-well investments totalling billions of dollars. They play an important part not only in successful oil-well completion, but also in long-term operation.

As wells go deeper, the difficulties and costs become even greater. You need the cements you can depend on for uniform quality and outstanding performance under any oil-well condition.

This new Lake Charles plant places an important source of cements for every oil-field job within immediate reach of the Gulf Coast oil industry.

Strategically located on the Calcasieu River, close to the Gulf of Mexico, and situated between Lone Star plants at New Orleans and Houston, this plant ships by water and rail.

Among the performance-proved Lone Star cements available through the Lake Charles plant are those favored by oil men everywhere:

Lone Star Portland Cement . . . 'Incor'* high early strength Portland Cement . . . and 'Texcor'* Deep Oil-Well Cement, which has special properties required in the deep, hot corrosive wells of Louisiana and vicinity.

Be sure to select the LONE STAR CEMENT that fits your job — for best results in performance and protection.

*Reg. U. S. Pat. Off.

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the OIL AND GAS JOURNAL

March 3, 1958

OCAW GOALS for 1958 are outlined by union's bargaining-policy committee. OCAW Pres. O. A. Knight is shown addressing the group. Others (left to right) are E. E. Phelps, research director; T. M. McCormick, secretary-treasurer; and B. J. Schafer, vice president. Besides long-range targets . . .

More Pay, Fewer Layoffs Demanded

THE 1958 collective-bargaining program of the Oil, Chemical, and Atomic Workers International Union contains three immediate goals:

1. **Wage increases** equal to the rise in the cost of living, plus a 3½ per cent annual raise.
2. **Longer contracts** with automatic annual wage adjustments.
3. **Greater protection** against layoffs.

These objectives, and others of a long-range nature, were adopted by OCAW's bargaining-policy committee at a 2-day closed-door meeting at union headquarters in Denver.

The committee's policies are mandatory for the 105,000 members in the petroleum and petrochemical industries. The international union will not approve contracts which do not contain the three provisions. Another 105,000 OCAW members working in the chemical and atomic industries were urged, but not ordered, to follow the pattern.

Wage goal . . . The 52-member policy committee directed the union's locals to secure increases equal to the rise in the cost of living since the last wage hike for the group. The federal Government's index would be used as the base.

Last year's 6 per cent increase for OCAW went into effect generally May 1 (OGJ, June 10, 1957, p. 64). From May 1 through January, the U. S. Department of Labor showed a 2.26 per cent increase in the cost of living.

In addition, the locals were instructed to seek a 3½ per cent annual increase, which the union contends is the annual increase in output per man-hour of the average American laborer. The union claims that in the oil and chemical industries, the annual rate of increased output per man-hour of labor is greater than this, but that wages should be increased on the basis of the total economy.

The present average wage for OCAW members working in petroleum and related fields is $2.70 per hour.

Layoffs . . . An unusual procedure was advanced by the committee to halt spreading layoffs. Here's what the two-point program calls for:

. . . When an employer lays off 5 per cent of the work force in a bargaining unit at one time or within a 1-year period, OCAW must be notified 4 months in advance of such layoffs and must be permitted to reopen its contracts for bargaining on wages and hours.

. . . Employes would be paid a "substantial" severance allowance if involved in a layoff. No formula for determining severance pay was disclosed.

The committee also recommended that OCAW locals press for contracts of 2 or 3 years' duration, with wages to be automatically adjusted annually in line with cost of living and productivity of the economy.

Long-range targets . . . In addition to the goals to be sought this year, the policy committee charted five recommendations which locals may work toward now but which are expected

to be carried out only after 3 to 5 years of sustained effort:

... **Reduced work week** for employes, rather than layoff of part of the working force.

... **Curtailment of overtime work.** The employe would be allowed to offset overtime by taking time off from regular hours at a later date.

... **Joint union-management** training programs to equip members for new skills required by automation or other technological advancements.

... **Full payment** by the company of pension, medical, and hospital plans, as well as insurance and other benefits.

... **A greater vesting** of pension fund money to the individual employe's account so that if he should leave a company before retiring he could collect his share of the pension funds. Eventually, the committee said, demands will be made that any employe of 5 or more years' service be given full ownership of all funds invested to his account in a pension fund.

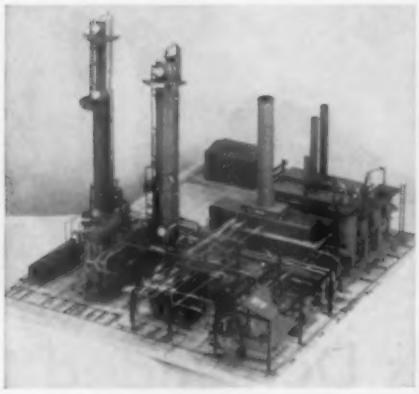
The policy committee instructed OCAW's president, A. O. Knight, to present to the group's next meeting details for establishment of an investment plan for workers to be financed by royalties on company production. The date for the next committee meeting was not disclosed.

Knight has suggested that a fund created by royalties could be administered jointly by union and management as a savings and emergency fund for the employes. Each worker would be credited for his prorata share of the fund.

Knight said no target date for accomplishment of any point in the collective-bargaining program will be publicly announced.

A few OCAW contracts are open for negotiation now, but the bulk of the union's 700 agreements in the petroleum industry will open during the late spring and early summer.

The policy committee, representing both the U. S. and Canada, is composed of 32 rank-and-file members of the union elected by their various districts, 16 district directors, and 4 international officers headquartered at Denver.



THE MODEL above helped speed construction of Bay's cat reformer, right, at Denver. The unit will go on stream within 9 months of the time contract was let because . . .

Building from Models Will Save Time

BAY PETROLEUM CORP. is nearly ready to put its 3,800-bbl. catalytic reformer on stream at Denver, although the company let the contract for the job just last June 9.

Credit for the speedy operation is given a new approach to design engineering, developed by the contracting firm, M. W. Kellogg Co. The new approach consists of doing all planning work around a model of the unit and using a "task force" of engineers to eliminate time-consuming paper distribution.

The system permitted Kellogg to complete engineering work in mid-September, just 13 weeks after the contract was let. Materials were on the building site ahead of normal delivery schedules, and ground was broken and construction begun in late October.

Feed stock was scheduled to be turned into the Sinclair-Baker-Kellogg cat reformer about March 1.

Kellogg's models are realistic and practical. The parts, made of colored polystyrene and scaled ⅜ in. to a foot, first were located within the plot area. Then major and later subsidiary lines were put in place. Finally, yard banks and platforms completed the model.

Use of the model for the Bay Petroleum reformer was the first instance of designing directly on the model, the engineers said.

Here are some of the advantages to working from a model:

... **Design changes** can be made rapidly because a model gives a clear picture of the finished job.

... **Redesigning** can be accomplished quickly. On paper, it could take hours of calculations and redrawing. On the model, both the original and alternate can be examined quickly in relation to the whole.

... **Models** make it easier to provide for proper clearance.

... **Construction sequence** can be planned more accurately, an important consideration in areas of limited access such as the Bay plant.

... **Engineering specialists** can operate more easily as a team when working from models instead of drawings.

... **The customer** can "see" more readily what the plant looks like and can approve the design quickly.

Fresh Assault on Imports

. . . will be made by producers this week. IPAA's plan for controls tied to 1954 demand has biggest support.

DOMESTIC PRODUCERS will tell Congress this week that the voluntary oil import program has failed.

But their plea for mandatory controls will be countered by jobber interests and a couple of major companies opposing import restrictions.

The House Ways and Means committee, now in its third week of hearings on extension of the Reciprocal Trade Act, will get the oil-import story in two installments.

First to appear will be a half-dozen producer groups, the National Coal Association, and others seeking import control by law.

More than a score of witnesses opposing control will come before the committee 2 days later.

The cabinet oil committee, meanwhile, is expected to start its new survey of the import program.

Requests for quotas totaling some 240,000 bbl. daily were received in 2 weeks of hearings. But a number of applications came in during and since those hearings to raise the total to nearly 300,000.

Imports administrator, Capt. M. V. Carson, reviewed the hearings quickly. His recommendations already have gone to the cabinet committee.

Canadian issue . . . Review of the program will include consideration of Canada's protest against District 5 (West Coast) controls, which went into effect in January.

The U. S. note to Canada pointed out that the West Coast program is designed to meet an import condition that threatens the domestic industry.

The note added: "It is, however, an action which, in the opinion of the U. S. Government, will have relatively little impact on current purchases of oil from Canada by companies which have been buying in Canada."

Major buyers of Canadian crude in District 5 are General Petroleum Corp., Shell Oil Co., and The Texas Co.

The U. S. Government pointed out it could not limit imports in a manner which would discriminate in favor of particular countries or companies.

Trade barriers opposed . . . The first word given the House committee on imports came from Sidney A. Swensrud, former chairman of Gulf Oil Corp.

Speaking as chairman of the Committee for a National Trade Policy, Swensrud asserted that higher trade barriers would not help pull the U. S. out of its present business slump.

"Increased trade restrictions would have an adverse effect on our exports, total unemployment would rise, and the consequent reduction in purchasing power would generate even more unemployment," Swensrud said.

Several proposals to force import controls will be offered the committee this week. The biggest support is expected to develop for a plan of the Independent Petroleum Association of American to fix import quotas by a formula based on the relationship in 1954 of imports to domestic demand. Imports in excess of quotas would be penalized.

But observers point out that the problem is not just one of ordering mandatory controls. It is the "how" of applying them.

If Congress should enact a quota the mechanics of its enforcement would be left to a government agency. And the agency would face the same issues that now confront the cabinet committee.

Report is ready . . . Carson is expected to report this week that January imports on the East and Gulf coasts showed a sharp increase over December.

First reports on the working of the new program for District 5, however, are expected to show that entries in January were well under the recommended level. Receipts on the West Coast reportedly were close to 50,000 bbl. daily below the suggested 220,000 bbl. limit.

But imports into Districts 1-4 are reported to have been more than 50,000 bbl. daily above the suggested 771,400-bbl. level for January.

For the country as a whole, therefore, imports were close to the figures laid down in the two programs for January.

Imports in Districts 1-4 are believed to have dropped in February, but the January bulge is expected to be repeated in March. Thereafter, imports may fall off—but not enough to bring East and Gulf Coast receipts for the 12-month period down to program.

The established importers and many of the newcomers are holding close to their quotas. But the cabinet committee will have to decide this month how to ask them to move over to make room for first-time importers who may be given around 75,000 bbl. daily as a result of last month's hearings.

Ike says he'll sign it, so . . .

Gas Bill Due House Vote Soon

PLANS FOR A HOUSE TEST of the Harris gas bill are being speeded up under the impetus of White House support.

President Eisenhower strongly indicated last week that he will sign the bill if passed by Congress—provided there are no further provocative incidents.

Eisenhower told a news conference the Porter letter has not changed his belief in the basic merits of the measure to lighten federal control over the natural-gas industry. But he said he hoped it would prove to be an isolated instance.

The President was asked directly whether the letter had changed his views on the merits of the bill.

"No," he replied. "It has not changed my mind on the merits whatsoever. That, to my mind, hopefully, is an isolated instance which will never be repeated."

Eisenhower's statement did much to dispel the "Porter blues" of supporters of the measure.

The bill was given a serious setback last month by a Republican national committeeman.

The $100-a-plate dinner was in honor of Rep. Joseph W. Martin of Massachusetts, minority House leader. Porter said it was up to Martin to deliver 65 per cent of the Republican votes for the measure. And to do so he would have to put consumer state members "on the spot politically." (OGJ, Feb. 17, p. 66).

Disclosure of the letter revived the cry of "arrogance" raised by the President when he vetoed similar legislation 2 years ago because of a $2,500 campaign fund offer to Sen. Francis Case of South Dakota.

At the capitol, now, both sides are lining up arguments and votes for the fight which will erupt when the bill is called up. House leaders, however, have not announced when the measure will be considered.

Venezuela Today: Calm, Busy, Thriving

Oil men are turning up important new production. The political outlook is good, but oversupply is pinching back operations. That's the view of a Journal representative who stayed around after the revolution to size things up.

Oscar B. Irizarry

THE REVOLUTIONARY upheaval has subsided enough in Venezuela now that oil men are able to survey their position.

I have just returned from that troubled country with some very definite general impressions—some good, some disturbing.

These impressions are based on witnessing the violent events that forced the regime of Perez Jimenez to flee and on the amazing show of popular unity that allowed the junta headed by Rear Adm. Wolfgang Larrazabel to consolidate its position.

After the revolutionary show, I was able to gain audience with the new members of the Ministry of Mines and Hydrocarbons and later to talk with oil men at the executive and operating levels throughout the country.

From these experiences. I brought back two impressions about the political future in Venezuela. The country:

... **Shows promise** of moving toward a democracy.

... **Still desires a favorable climate** for oil, although this could change under political or economic pressures.

As for oil-company operations in the country, these trends are taking shape:

... **Lake Maracaibo** is rising to even greater stature as an oil province with a "Golden Lane" developing in midlake. The newcomers have hit with good discoveries.

... **Newcomers to other areas** of the country haven't done so well yet.

... **Drilling activity** is feeling a pinch similar to that being experienced by contractors in the United States. Wildcatting to prove new concessions is still being pushed, but development drilling is being cut back.

The Golden Lane

Wildcatting on new concessions in Lake Maracaibo has turned up some prolific producers along with a few dry holes.

The hottest trend shaping up is a Golden Lane of heavy producing wells. It begins at the southeast corner of Creole's old concession area, down Superior Oil Co.'s block (see map) and extending into Block 1 held by the Sun-Atlantic-Seaboard group.

Dr. Oscar B. Irizarry, center, has just returned after 5 weeks in Venezuela. Irizarry is publisher of the Journal's sister publication, Petroleo Interamericano, and a well-known Latin American oil figure who has traveled extensively (see p. 57).

He is pictured here at Jusepin with W. F. Ganskopp, left, engineer in charge of gas production for Creole, and W. I. Christie, Creole's production supervisor.

The accompanying report describes the Venezuelan scene today and gives some clues as to what may be expected in the months to come.

The trend could easily extend northeast into Shell's old concession area and east into Mene Grande's holdings. Effect of a dry hole in Block 12 to the west on the trend still hasn't been fully assessed. Block 12 is held by the Sun-Atlantic-Pan American-Seaboard group.

Superior's success . . . Five prolific discoveries by Superior form the backbone of the Golden Lane trend.

Superior already has produced 588,548 bbl. from these wells through January, and they are being allowed to flow at a total rate of 11,000 bbl. daily. They could flow much greater, however, because all tested originally from 7,000 to 11,000 bbl. daily (OGJ, Jan. 6, p. 88).

Superior currently is constructing one of the best piers in the eastern section of the lake at San Francisco on the outskirts of the city of Maracaibo to handle barge movement of the crude.

Sun group hits . . . The Sun-Atlantic-Seaboard group has two wells in the northern tip of its Block 1 (SVS-X-4 and SVS-X-5) which are producing at the rate of more than 6,000 bbl. daily from Eocene sands.

They are just south of Superior production. Production is from 10,000-ft. depths. One reportedly has 900 ft. of producing sand and the other 360 ft.

South of its two good wells, the Sun group has a 500-bbl. daily producer (SVS-X-1) which is shut in as noncommercial for the area. The well, however, has some significance: It produces from a Cretaceous sand, the only such production so far found in Lake Maracaibo. Its total depth is 13,000 ft.

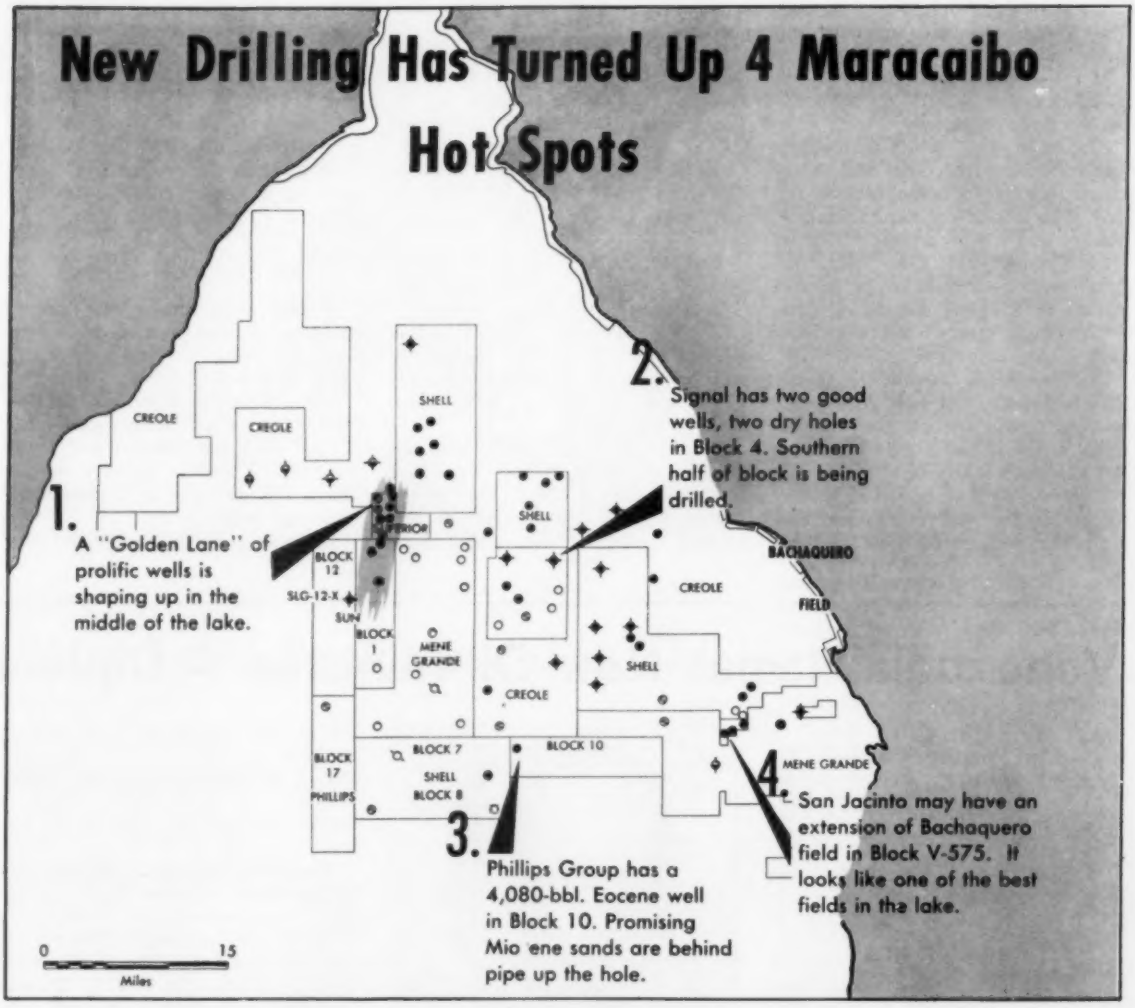
Southwest of the shut-in producer, Sun drilled a dry hole (SLG-12-X) in Block 12 after going to 13,006 ft.

Extent of the Golden Lane will be known before too long. Sun has a location staked on the trend in the far south portion of Block 1. Mene Grande has two locations staked in its Block 2 to the east.

Report on Signal . . . The Signal-Pure-Sohio-Hancock group has two good wells in Block 4 farther east.

Its Centro II-X well was good for 2,500 bbl. daily through ⅝-in. choke. It was perforated between 12,113-93 ft. with total depth at 12,779 ft. The Centro III-X tested 3,000 bbl. daily from perforations at 11,807-12,184 ft. with total depth at 12,533 ft. Both are Eocene wells.

The same group didn't do so well in the northern section of its block, although the initial outlook was good because of Shell production in the block adjoining. One well was drilled through the B zone and suspended at 9,000 ft. as dry. A second to the west also was abandoned as dry.


New Drilling Has Turned Up 4 Maracaibo Hot Spots
1. A "Golden Lane" of prolific wells is shaping up in the middle of the lake.
2. Signal has two good wells, two dry holes in Block 4. Southern half of block is being drilled.
3. Phillips Group has a 4,080-bbl. Eocene well in Block 10. Promising Mio ene sands are behind pipe up the hole.
4. San Jacinto may have an extension of Bachaquero field in Block V-575. It looks like one of the best fields in tha lake.
CREOLE
CREOLE
SHELL
SHELL
SUPERIOR
BLOCK 12
SLG-12-X
SUN
BLOCK 1
MENE GRANDE
CREOLE
CREOLE
SHELL
BACHAQUERO FIELD
BLOCK 17
PHILLIPS
BLOCK 7
SHELL
BLOCK 8
BLOCK 10
MENE GRANDE
0
15
Miles

The combine now has its Centro IV-X in the southern sector of the block drilling. A string of 13⅜-in. casing has been set to 2,265 ft. It also has three locations staked on the eastern and southwestern edges of the block.

The Signal group has one rig under contract but is bringing in a second to step up the exploratory work.

Phillips . . . The Phillips group has a good well in Block 10, the most southern of the new lake concessions.

The well tested at the rate of 4,080 bbl. daily through ¾-in. choke, with 650 psi. tubing pressure. The well could be a dual producer.

The same group has another well drilling in Block 17 to the west.

Interest holders besides Phillips are San Jacinto Petroleum Corp., El Paso Natural Gas Co., Western Natural Gas Co., Sunray Mid-Continent Oil Co., and Pacific Petroleums, Ltd.

Shell . . . Shell has six exploratory rigs working in the lake and is keeping a tight rein on information.

Company has two wells drilling in Blocks 7 and 8, which lie between the two Phillips blocks. They are reported around 14,000 ft.

Eastern lake section . . . This area, which may develop into an extension of Bachaquero field, well could turn into the best area of the lake.

Shell reportedly has some good wells in its Block D of V-574.

San Jacinto group has one of the best blocks in the lake in its V-575 Sobrante. First well in this block produced from Miocene at rate of 5,740 bbl. daily through ¾-in. choke. Depth is around 12,000 ft., but drilling is easy with completion time of 10 days. This is phenomenal when compared with normal drilling time in the lake of 70-90 days.

The second and third wells are being completed. Production reportedly is at about same rate as the first.

The group is completing storage facilities at San Lorenzo for 190,000 bbl. and has completed 12 miles of 12-in. pipeline to the terminal. Production from the block is rated at 17,000 bbl. daily now.

Other interest holders besides San Jacinto are Union Oil Co., Murphy Corp., Monsanto Chemical Co., Tennessee Gas Transmission Co., American Petrofina, Inc., and Sharples Oil Corp.

Mene Grande is tight with information on its block south of V-575 and east of Block 10. Reports in Venezuela, however, rate prospects here as not spectacular.

The Other Areas

The success of companies who have started exploration programs in other areas of the country away from Lake Maracaibo has been less than sensational.

Pan Venezuelan has drilled eight wells in Eastern Venezuela. Reports say the firm has four indicated pro-

ducers, four dry holes. One well testing 400 bbl. daily on the pump but was abandoned as noncommercial.

In the Barinas area, southwest of the lake, I was able to get information on three operations:

... **Creole**—has two rigs drilling. One started in December and is reported to have just completed a dry hole. The second rig started work in January and still is drilling.

... **Kingmill Oil Co.**, C.A., has turned over operations of its Barinas acreage to Sykes & Associates, C.A. a consulting group. Sykes is now dealing with contractors.

... **Venezuelan Atlantic** reportedly has completed a dry hole on its tract between Creole's block and San Silvestre field. It has a rig of Reading & Bates under contract.

Interest, meanwhile, is high over the outcome of the first wildcat testing a big block in the Gulf of Paria between Trinidad and Venezuela's northeast coast.

Paria Operations, Inc., is operating there, but the well is a tight hole and little information is available on it. The combine is owned by Continental Oil Co., Ohio Oil Co., The Texas Co., Cities Service Co., Richfield Oil Corp. The five lumped bids of $100 million together to get the 152,000-acre concession.

The oil industry in Venezuela is beginning to feel the same pinch that is prevailing in the United States.

The loss of export markets to this country and the general picture of world oversupply of crude has caused a cutback already of more than 200,000 bbl. daily.

As a result, the prospect of any new concessions being thrown open for bids this year is dim. This is the reason for limiting exploratory and drilling activity. Companies have trimmed back their development work and are doing only the necessary drilling to prove up reserves.

Fifteen drilling-contracting firms have 111 rigs in the country. Reports are that from 40 to 50 of the rigs currently are idle. This has momentarily lowered the prospects of Venezuela as a place for moving drilling equipment from the U.S.

The Political Outlook

It may seem strange that anyone could see signs of growing democracy amid the furor of revolution in Caracas. But I did.

When Perez Jimenez flew out of the capital for the Dominican Republic and his hated national police was shattered, a police vacuum existed. There was no force to impose discipline and public order.

But encouragingly, the general pub-

Venezuela Names New Oil Minister: A Diplomat

AFFABLE Dr. Carlos Perez de la Cova left Washington hurriedly for Caracas February 21, accompanied by his wife in response to a hasty summons from the junta now governing Venezuela.

Washington had some hint of the importance of the trip when the couple left daughter, Beatrice, a student at Georgetown University, and Carlos Edward, who attends Longfellow School for Boys, behind. Two days later the reason for all the haste was known.

The personable engineer-diplomat is the new head of one of the world's most important oil regulatory bodies, Venezuela's Ministry of Mines and Hydrocarbons. Dr. Perez was named minister last week to succeed Dr. Jose Lorenzo Prado, the ministry's top analytical chemist who held the job for only a few weeks. Presumably Dr. Prado will now get back to his scientific pursuits in the ministry.

The new minister, just about as well known in U. S. oil circles as in those of his own country, is particularly well suited for the job. His experience and qualifications are probably unique. Carlos Perez de la Cova knows Venezuela's oil industry intimately on the field level. What's probably more important to Venezuela, the world's foremost oil exporting country, the multilingual minister knows his way around on an international diplomatic level.

The appointment of Dr. Perez should go a long way to quiet any fears American oil men might have

Perez de la Cova
... Venezuela's top man in oil.

concerning their future in Venezuela. As one of the architects of the country's very successful philosophy of allowing private capital to work for its benefit, he believes in the system firmly. Just a week ago he confirmed that belief.

"The development of the oil resources of Venezuela by foreign capital is based on the system of free enterprise and on the institution of private property," he commented. "Venezuela believes in those principles and had found it convenient and practical for her national interest to explore and develop her oil resources through concessions awarded to private companies, technically and financially able to carry out their legal obligations under the supreme vigilance of the state."

From now on, more than ever, the responsibility for that "supreme vigilance" will rest with Dr. Perez.

He is well qualified to take on the job. He was a member of the presidential commission which drafted Venezuela's present petroleum code in 1943. The law has since served as a model for most of the rest of the world. He also is an expert on Venezuela's income-tax laws, particularly as applied to oil operations and is well suited to be the official guardian of Venezuela's rights in this respect.

Oil philosophy . . . He cites figures to back up his strong belief in Venezuela's philosophy of encouraging private companies to do its work for it. By the same token he has little regard for the extreme nationalism which prohibits private companies in some countries.

"The resounding shibboleth heard in those countries, 'Petroleum is ours,' has no practical meaning at all" he says flatly.

"In Venezuela, also, the petroleum is ours. But we believe that as long as it remains underground, it benefits no one. In other words, we believe in a producing wealth instead of a dormant wealth."

lic responded to the orders of Boy Scouts, the National Guard, and vigilantes organized from university students and professional groups. The inspiration for this spontaneous cooperation was all the more remarkable when it prevailed at a time of uncontrollable hate for the ruthlessness of the national police.

This sort of national discipline and the willingness of all political parties to join hands to overthrow a dictatorship and start work for a national democratic election augur well for the future.

Along with this atmosphere of democracy, the new junta has expressed its confidence in the value of free enterprise. Oil men, for the moment, all feel the climate is good for continued operations and new investment.

Two possibilities, however, could change this climate:

. . . Severe recession.

. . . Political split in Venezuela.

With production already cut back more than 200,000 bbl. daily and with the prospects of more cuts, the possibility of a severe pinch in the government's income from oil has the industry worried. Such a situation could give politicians ammunition for attacks on the industry.

For the moment, all political parties, including the far left-wingers, are cooperating to support the junta. This includes some sources unfriendly to oil. If this honeymoon should suddenly end and a struggle for power should develop, it might also spell trouble for oil.

For oil men, it means they will continue their traditional policy of staying out of politics and trying harder than ever to be good citizens of Venezuela and cooperate with a government that has given them guarantees of respect for private property and investments.

With a Solid Background in Oil

Shortly after the revolution overthrew Venezuela's military regime a month ago, some quarters in Caracas began to snipe at U. S. restrictions on oil imports as damaging to Venezuela. There was almost a hue and cry to stop buying U. S. goods unless Venezuelan oil was allowed to flow freely northward.

The new minister never joined in this clamor. He's much too much a diplomat. But, he's quick to point out the facts and let them speak for themselves. Perez de la Cova will tell you very quickly that oil is the key to Venezuela's trade. It accounts for 90 per cent of the country's imports.

In the same breath, he reminds that Venezuela is the best customer the U. S. has in Latin America. U. S. goods account for 60 per cent of all Venezuelan imports. On a per capita basis, Venezuelans buy more U. S.-produced products than anyone in the world except the Canadians.

The new minister takes with him to his new job a firm belief in private enterprise and at the same time a profound dedication to protect the interest of his own people. His past record maps the qualifications and experience that made the Caracas junta tap him for the job.

Background . . . The 54-year-old minister was born and educated in Caracas. He graduated as a civil engineer from Caracas' Central University and when only 24 received his doctorate in physics and mathematical sciences at the same university.

Dr. Perez later attended the University of Oklahoma, University of Colorado, and University of Tulsa. He earned a petroleum-engineering degree with a major in refining at Tulsa in 1941.

From 1930 to 1937, he worked as a field inspector in western Venezuela. This was after he was instrumental in founding Venezuela's Technical Petroleum Department, forerunner of the ministry he now heads.

Twice from 1937 to 1943, he was director of hydrocarbons. He left this position to become the head of the Department of Concessions and Cartography of the Technical Bureau of Hydrocarbons. It was in this position that he served as a member of the commission which drafted the 1943 petroleum law which is still the basic law of the country's oil industry.

Perez de la Cova left government service in 1945 for the first and only time in his career. He became chief of the land department and a member of operating committee for Phillips Petroleum Co. in Venezuela for 5 years.

It was in 1950 that he stepped for the first time into the rarefied diplomatic atmosphere. He was appointed counselor of the Venezuelan embassy in Great Britain with the rank of minister. Two years later he moved to Washington with the title of Minister Counselor of Petroleum Affairs for the Venezuelan embassy.

Industry briefs

A move is under way in Nebraska to obtain passage of oil conservation statutes at the 1959 session of the state legislature.

A legislative study committee on oil and gas conservation is holding hearings on proposed legislation, and reaction so far has been favorable. The latest hearing in Lincoln was told that most major oil producers as well as the larger independents operating in Nebraska, favor reasonable conservation legislation.

Proposals failed in both the 1955 and 1957 sessions of the legislature.

Warren D. Sorrells, Fort Worth, has sold his interests in 19 producing oil wells in Coleman County in West Central Texas to Hamer Corp., El Dorado, Ark., for $175,000 in cash plus a 37½ per cent reversionary interest. Hamer Corp. quickly turned the properties to Richard A. Hall of Abilene, Tex. The wells are in Coker (Gray sand) and Coker (Morris sand) pools. Hall intends to carry out a water flood in the Gray sand and later to start a pilot flood in the Morris sand pool.

A Florida court has ruled in favor of Coastal Petroleum Co. in a 3-year dispute with the state over mineral rights on 4,500,000 acres of tidelands and inland-water leases. The state argued that leases on areas along the West Coast and several river and lake bottoms, including 660,000-acre Lake Okeechobee, limited rights to oil, gas, and other soluble minerals. The company contended the leases covered rights to all minerals, including metallic. The circuit court of the second judicial court for Leon County made the decision.

Du Pont has sold its American Glycerin section, an oil and gas well shooting service, to American Glycerin Co., Bradford, Pa., a new firm. Du Pont said it will continue manufacturing explosives and other well-shooting devices but is getting out of the marketing end of the business. Most of the 21 persons in Du Pont's well-shooting service work will join the new company.

Seminole Oil & Gas Corp., Dallas, has acquired a 50 per cent working interest in 1,360 acres in Stephens County, Texas, from Olsan Bros., Inc. A drilling program in the Mississippian at 4,500 ft. is scheduled to start in April. Oil & Gas Management, Inc., Dallas, will direct operations for the joint interests.

Gas Lines From Canada

. . . are good bet for future because of mutual interest with U.S., FPC member says. But Canada must fix policy.

PROSPECTS are excellent for building new natural-gas pipelines from Western Canada to United States markets.

This is the opinion of William R. Connole, member of the Federal Power Commission, which must pass on any proposed project. Connole addressed the pipeline division of the American Society of Civil Engineers in Chicago last week.

He, of course, could not comment directly on specific proposals for import. Hearings have been completed on the Midwestern case, in which a Tennessee Gas Transmission subsidiary proposes to import 200,000 M.c.f. daily into the Midwest. A decision in the hotly contested case may come by late summer or fall.

Two other major companies, Westcoast Transmission Co., Ltd., and Alberta & Southern Gas Co., Ltd., envision gas imports into California. Their cases are not yet before FPC.

Mutual interest is key . . . All new pipelines hinge of Canada's Borden Commission study, which will determine Canadian reserves and how much surplus gas, if any, is available for export. The report should come this year.

Connole emphasized that he was not commenting on the possible outcome of this study or any particular prospects. But as to the general outlook for new international pipelines, he said:

"Personally, I think the prospects are excellent."

The commissioners said any attempts to distribute energy between the two countries must be based on the mutual interests of both.

"My optimism that the mutual best interest of Canada and the United States will require some utilization of Canadian gas in America is the reason why I feel that the remaining problems will be solved," Connole said.

U. S. import policy . . . Connole noted that ground rules and precedents for importing natural gas into this country now exist.

He cited that Texas Eastern Transmission Corp. line tapping northeast Mexico reserves and the Westcoast Transmission line from British Columbia into Washington State. Both started operating last year.

The Natural Gas Act, which spells out FPC authority over imports and exports, states in Section 3 that the commission shall issue an order authorizing exportation or importation upon application "unless after opportunity for hearing it finds that the proposed exportation or importation will not be consistent with the public interest."

Connole pointed out that the Congressional mandate is worded affirmatively. "The commission," he said, "is directed to issue a certificate unless it finds that to do so is contrary to the public interest. This I interpret as an expression of congressional intent favorable to the authorization of international pipelines."

One limitation adopted as part of U. S. policy is that no major area shall be completely tied to, and dependent upon, an exclusive source of foreign supply.

Canadian export policy . . . Authority for construction of oil or gas lines in Canada rests with the Board of Transport Commissioners, under terms of the Pipelines Act.

This act states: "It (the board) may make orders and regulations with respect to all matters relating to traffic, tolls, and tariffs of oil pipelines, but it does not have similar powers over gas pipelines."

Canada has approved one major export project — Westcoast Transmission. But Connole said Canada has not developed a definite natural-gas exporting policy. He expects the Borden commission to help develop such a policy.

Worse than a crap game . . .

Big Stake Lost—and No Action

FOR THOSE who believe the oil business is a sure-fire road to riches, let them read this story.

Shell Oil Co. and Continental Oil Co. last week dropped $500,000-plus in California on an exploration deal without even so much as staking a drill site.

It happened like this:

Along scenic Santa Monica Bay in southern California are a number of small beach communities which own title to their own tidelands.

One of these, Redondo Beach, has been the scene of a successful tideland oil development in the last couple years.

Just to the north of Redondo Beach is the little city of Hermosa Beach.

Last year, Hermosa Beach was courted by a number of oil companies interested in drilling its tidelands. Bids were called for. Shell Oil Co. and Continental Oil Co. made a high joint-bid which stood to net the city more than $11 million if oil was found.

Part of the deal between Hermosa Beach and Shell-Continental required the oil companies to put up $500,000 as a cash bonus at the time the papers were signed last fall.

There was one slight hitch. Hermosa Beach had a 20-year-old ordinance against drilling in the city.

So, another part of the complicated deal called for the oil companies to pick up the tab on a special election aimed at repealing the ordinance. But, regardless of the outcome, the city could pocket the $500,000.

The election was held last week. The final count: 1,815 votes for repealing the drilling ban; 2,325 against.

The city didn't get off scot-free. Officials are faced with the problem of disposing of a mountain of grandiose plans the voters of Hermosa Beach mailed in on what to do with the flood of oil money that would pour in after the election.

The two oil companies were gracious in defeat. They issued a statement expressing appreciation to those who voted for them and expressed a desire to work with the fine people of Hermosa Beach again some day.

California Claims Oil Land

OIL-RICH tidelands in Wilmington field are the target of a lawsuit being prepared by the State of California against Union Pacific Railroad and Southern California Edison Co.

The state says part of the land held by the two companies is artificially filled tidelands and not upland property. If the state can make its claim stick, it can collect 50 per cent of the oil revenue from the disputed property with the other 50 per cent going to the city of Long Beach.

The state hasn't set a date for filing the suit. There's also a possibility other land may become involved.

UOP Sale OK'd

but Guaranty's 10 per cent commission denied by Loeb.

FURTHER COURT haggling appeared in prospect last week over sale of Universal Oil Products Co. Referee Louis M. Loeb approved sale of the company but disapproved a controversial commission to Guaranty Trust Co.

Loeb's recommendations were made to the New York Supreme Court. The New York Attorney General now is expected to move for confirmation of the report. Guaranty has indicated it will recommend a countermotion.

Loeb recommended Guaranty Trust be empowered to sell the UOP stock under a previous agreement. Terms would be that UOP continue its services to independent refiners, that the stock be so widely distributed that no individual investor could obtain more than 2 per cent, and that three specific directors be placed on the board.

Loeb also recommended an accounting of the sale be made to the court. He said sale of UOP stock and investment of the proceeds in a diversified portfolio would produce a more stable income for the trust. Beneficiary of the trust is the petroleum research fund of the American Chemical Society.

The referee praised the efficient administration of UOP affairs by Guaranty Trust. But he pointed out the trust firm had received $50,000 annually for its services since 1944 and under present arrangements that fee is all it is entitled to.

Guaranty Trust had proposed the sale originally with a 10 per cent commission. This would mean $4,750,000 to $7,500,000 in commissions.

Congress Studies Tax Cut

REPEAL of the federal transportation taxes is being pressed in Congress.

The Senate commerce committee is almost solidly behind a move to lift these levies through a tax bill already passed by the House and soon to come up on the Senate floor.

The transportation tax adds 3 per cent to the cost of moving oil by railroad or for-hire tank truck, 4½ per cent on pipeline traffic, and 10 per cent on passenger tickets.

Backers of repeal point out that since the tax is imposed on every movement from raw material to finished product the cost to the consumer pyramids to a point where it becomes an unhealthy obstruction to economic recovery.

watching WASHINGTON

. . . with Bertram F. Linz

● Road program at the crossroads

CONGRESS may make important changes in the $35-billion road program this year.

Talk a few months ago of spreading the job out over maybe 20 years has suddenly changed to talk of speeding it up as a spur to lagging business.

A staggering 37 per cent increase in the cost estimate—as of now—recently dismayed the highway planners. It opened up a vista of increased taxes or delay in building.

It was realized that this is not a time to add to the tax burden by calling for another $9 billion over the life of the program. On the other hand, a stretchout would leave the country 20 years from now with a road system that lagged 3 to 5 years behind needs.

There is no surplus money in the building fund to which the gasoline and other special taxes contribute. In fact, it will show a real deficit in another 18 months.

The original idea was that the new road should be paid for out of this fund. And there is a provision in the law which in effect demands that the program be kept on a pay-as-you-go basis.

There is some idea now that the financing system be modified until our economy is back on its feet. That would call for an appropriation by Congress out of general funds.

The tipoff on what Congress may do will come with bills to cut the Byrd-Humphrey pay-as-you-go clause out of the law.

● New barometer for business

EXPANSION PLANS of the oil and other industries, soon to be reported by the Government, will be a straw showing which way the economic wind is blowing.

The report, soon to be issued by the Commerce Department and Securities and Exchange Commission, will be scanned carefully by top officials.

If it shows that business and industry are planning substantial additions to plant this year, it will be an omen of improvement. On the other hand, if it discloses that expansion is being curtailed, it will be a warning that not all is well in industry.

The two agencies survey this phase of activity every 3 months. The last report showed that less will be spent for new plant and equipment this year than last. But the cut was not so great as to cause alarm.

More recently, however, business has fallen off badly. So the next report, showing how industry views prospects, will be highly informative.

● Antitrust scope may spread

THE JUSTICE DEPARTMENT is looking for new areas for enforcement of the antitrust laws.

A report reviewing the scope and effect of past cases and outlining new fields in which the department should act is now under study by Asst. Atty. Gen. Victor R. Hansen, head of the Antitrust Division.

The study was made by two outstanding economists. The purpose is to show the economic importance of past cases to the country as a whole. It is aimed at bringing out the impact of one case on other firms in an industry, and at showing whether cases have been confined to too few sectors.

One of the big questions put to the economists was whether reliance on complaints as the basis of cases has resulted in holes in enforcement.

The report contains many "helpful and interesting" ideas along these lines, Hansen says. Some of them may be adopted as part of the operating practices of the Antitrust Division.

Flood Report Holds Citronelle's Fate

Pressure in Alabama's biggest oil pool is doing an amazing nose dive. It threatens an early death to this once-promising field. A lot rides on current survey of water-flood possibilities.

PRODUCERS in Citronelle field, Alabama's biggest oil pool, last week were marking time watching the pressure drop and awaiting the answer to a big question:

Can Citronelle's tight Rodessa pay be flooded successfully?

If it can, the big field likely can look for a long, promising production future.

If it cannot, Citronelle may wind up as a costly flash-in-the-pan for many of the operators with production there.

The answer to the key water-flood question should come relatively soon—probably within the next 70 to 80 days. One of the country's top consulting-engineering firms (Core Labs) expects to complete its study of the field's flood prospects by then.

If the verdict is favorable, Citronelle producers will drive immediately toward unitizing the field. They should accomplish this quickly because the machinery is already there. Operators actually started unit negotiations in October last year.

Only four operators' meetings have been held since then, but progress has been swift. The traditional unit vehicle has been set up. The basic operators' committee is functioning along with its subordinate geological, engineering, and legal arms. A technician of Gulf Oil Corp., as the largest acreage holder in the field, heads each committee as chairman.

A time of waiting . . . Producers now, however, have gone about as far as they can in this direction.

Until they know whether pressure maintenance will add greatly to Citronelle's recoverable oil, they can do little but wait and wonder.

Meanwhile, bottom-hole pressure of the Rodessa continues to plunge.

From an original 5,000 psi. in August 1955, the pressure has fallen to an estimated field-wide average of only about 1,500 psi. The average daily drop has been a fat 4 psi. since the Zach Brooks Drilling Co. 1 Donovan tapped the 10,800-ft. Rodessa with the field discovery August 16, 1955. The plunge has accelerated in the past year and a half to a rate of about 5.2 psi. daily.

Field operators, furthermore, can see nothing to indicate that the pressure drop might slacken—at least before the pressure falls below the saturation level or bubble point. Most place this point at about 500 psi.

One operator expects Citronelle pressure to drop below the bubble point about the first of September this year. Other opinions are close to that.

Producing costs going up . . . These costs are plenty high already.

Many of Citronelle's 106 wells (16 of them producing from upper and lower Rodessa) can't make their current 200-bbl. daily allowables.

Fracturing has helped keep up production of some of them. That benefit is not expected to last long, and such techniques add to the number of barrels needed for payout.

Oil-lifting expense at Citronelle already is high and will go higher. Salt in well fluids pesters the field's hydraulic-pumping units and boosts maintenance expense.

One operator, General American Oil Co. of Texas, figures its lifting costs at about $1,000 a month per well, or about 30 cents a barrel.

A company engineer says: "Right now that isn't too bad, but you have to remember that our wells are still in the flush stage of production. Our lifting cost can and will go much higher—especially after we puncture the saturation-pressure level."

If pressure maintenance is not found feasible for Citronelle, these climbing per-barrel production costs will determine how long the field goes on producing.

Some engineers estimate that the economic limit—the point where costs outrun production income—likely will be reached when per-well output drops to about 15 bbl. daily.

How about payout? . . . While General American feels that lifting costs at Citronelle are high but not yet excruciating, some operators have a gloomier view.

General American is better off than many on two counts: It has some of the more favorably located central acreage in the field. It drilled its wells early.

Wells on the fringes aren't so productive. And those that came in later, after pressure had dropped 5 psi. each day since the discovery, can look for shorter producing lives.

The engineering concensus now is that the average Citronelle well will recover about 100,000 bbl. of oil to the bubble-point pressure, perhaps another 50,000 bbl. after that before being abandoned, assuming no secondary recovery.

This volume would probably pay out the average well. Little profit would be left, however, after deducting drilling costs averaging between $200,000 and $300,000 plus lifting and operating expenses.

The recovery figure mentioned is only an average. Some wells will do much better, some much worse. Some operators will make a nice profit, some may take it on the chin.

Some of the better performers in the field already have produced 125,000 bbl. and more and are expected to hit 300,000 bbl. or more without pressure maintenance.

The poorest ones, engineers think, will be lucky to get 50,000 bbl. There's no doubt about these—they're losers without some form of secondary recovery.

The field as a whole . . . In December, Citronelle's 4,240 developed acres and 106 wells produced 385,468 bbl. of oil.

PIPELINE

Southern Natural Gas Co. plans to start construction this week on a 42-mile gathering system in the Gulf Coast marshland of Plaquemines and St. Bernard parishes, south of New Orleans. Houston Contracting Co. will lay 10½ miles of 4-in., 9 miles of 6-in., 5 miles of 8-in., 8 miles of 10-in., and 9½ miles of 12-in. connecting Point Comfort, Eloi Bay, Lake Fortuna, North Black Bay, West Black Bay, Black Bay, and Lake Campo fields. The system will be tied in with the Southern Natural 20-in. trunk line in Plaquemines Parish. The project is to be completed May 1.

The Little Big Inch, reconverted from gas to products after a 3-year legal battle, is filling its Gulf Coast storage tanks in preparation for a

This swelled the field's total output to the first of 1958 to roughly 6,000,000 bbl.

Best engineering estimates say the field will produce 10,000,000 bbl. by this fall when pressure sinks to the saturation level. They estimate operators can coax out perhaps 5,000,000 more barrels of primary oil after that point for a grand total of 15,000,000 bbl.

That sounds like a lot of oil. But it's not much in view of the operators' best estimates that there was about 150,000,000 bbl. of oil in place originally. Ten per cent is low even for a solution-gas-drive pool.

Why a water flood? . . . Pressure maintenance, thus, is all-important to Citronelle's future. And operators awaiting the report on Rodessa floodability naturally are on pins and needles.

Water flooding, of the several secondary-recovery methods, appears to be the only route Citronelle operators can go.

Gas injection seems out. There is no local gas supply large enough to do the job. Operators conceivably could buy the needed gas from a big-inch trunk line which passes nearby. But this would be costly. The real stopper for a gas program, however, is the town of Citronelle which sits right in the big middle of the field.

Operators wouldn't take the risk of operating high-pressure lines in the town.

The same objections hold for a miscible-phase project. Any of the currently used versions of this technique would require both gas and pressure.

RARE SIGHT in Citronelle these days is a drilling rig. Only spot drilling continues, and that's done mostly by independents on field's edge where pay sand is thinning.

Flood delay inevitable . . . Provided operators soon find the Rodessa in Citronelle favorable for flooding, it still may be months or possibly years before a field-wide project can be kicked off.

The wheels of unitization roll slowly. Only the preliminaries are out of the way now. Operators first would have to agree on a formula which each thinks is equitable for sharing the pooled oil.

When this is done, they would have to tackle the tedious job of signing up the royalty owners. Citronelle community would complicate this job terrifically, too. Instead of the normal few score royalty holders for a field of this size, the operators must sign hundreds of town-lot royalty owners.

The prospective unit would have to sign up 75 per cent interest of the total royalty owners in the unit area under Alabama conservation laws.

Drilling decelerated . . . There is still some drilling in Citronelle, but it is a minor amount compared to the number of semiproved acreage still undrilled.

At last count, there were four rigs working in the field.

The bigger operators have practically quit drilling. Gulf, with about half the acreage in the field, gave up drilling early last fall. Since then Gulf has been parceling out acreage to independents on farmouts, whereby Gulf keeps an override and the farmout recipient takes over merely by meeting the lease obligations.

Citronelle still hasn't seen its productive limit defined in any direction. Essentially all holes drilled have produced oil. But it is obvious to operators that they can't step out further into the thinning sands without great risk. A few edge wells already have been plugged because their oil output was deemed uneconomic.

The drilling outlook is for only a sprinkle of projects. A favorable report on the field's secondary-recovery prospects might trigger a mild drilling hike. But most feel that the surge to develop the field's Rodessa pay, at least, is running out of gas.

BRIEFS

startup in April or May. The FPC January 2 gave final approval for the conversion.

New pumping equipment has been installed for several months, but actual start of operations has been delayed while batches are made up to fill the line. The 20-in. system extends from Baytown, Tex., 1,168 miles to Moundsville, W. Va., with a 230-mile, 14-in. lateral to Chicago. Line fill alone will exceed 2,000,000 bbl. Initial capacity will be 185,000 bbl. per day.

Four pipeline expansion projects of Transcontinental Gas Pipe Line Corp. have been combined into a single case to be heard shortly by the Federal Power Commission. The projects, costing $165 million, will tap gas supplies in Texas and Louisiana, provide field storage in Pennsylvania, and add horsepower to existing stations.

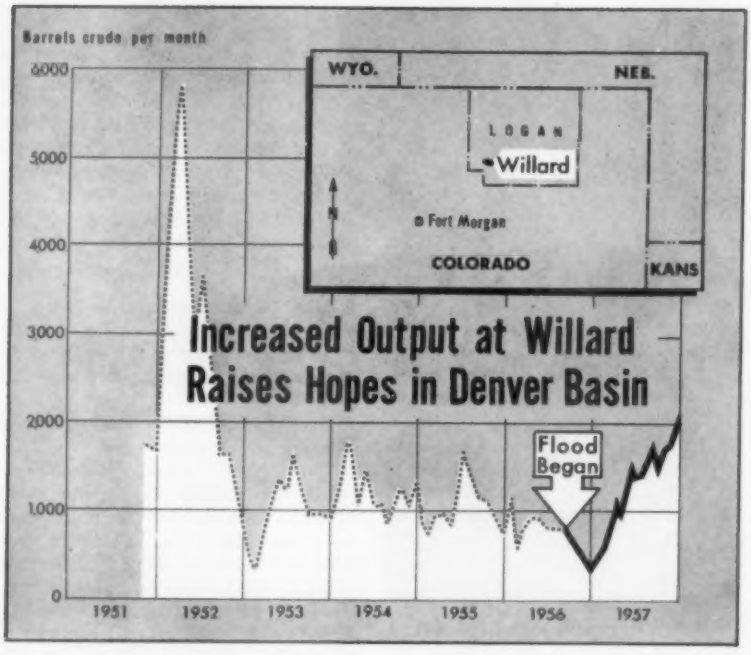
The case consists of Transcontinental's applications, requests by 25 Louisiana and Texas producers for sales certificates, and application by three companies to transfer interests in two Pennsylvania fields.

Kentucky Gas Transmission Corp., Charleston, W. Va., has filed application with the FPC for construction of 20½ miles of 26-in. natural gas line in Kentucky. The proposed line would cost $2,191,400 and would increase delivery capacity to the Cincinnati, Ohio, area from 437,600,000 to 470,400,000 cu. ft. daily.

Also for Pipeliners . . .

IN THE NEWS: Pipeline and terminal projects rank high in oil-industry activity in Venezuela these days (p. 65) . . . Prospects still are rated good for new gas pipeline from western Canada to United States (p. 70) . . . NPC survey emphasizes rapid growth in nation's pipeline facilities (p. 74).

PLUS THESE TECHNICAL REPORTS: Latest designs featured in El Paso's new Panoma gas-compressor station (p. 92) . . . Pipeline construction report (p. 171).



Colorado Flood Looks Good

A SMALL FLOOD in northeastern Colorado is giving operators an encouraging preview of what to expect from future water floods in the sprawling Denver basin.

Output of the four-well Willard pool in Logan County has risen sharply since Sinclair Oil & Gas Co. began injecting water into the D-sand formation nearly 17 months ago.

The tiny reservoir, a stratigraphic trap with no significant structure, is typical of other D-sand and J-sand reservoirs from which most of the oil in the basin is produced. Both zones have similar characteristics.

Colorado conservation officials say water injection so far has been "extremely beneficial" and predict that "future production will undoubtedly result in considerable production over recovery by primary methods."

The only major water flood in the Denver basin is in the J-sand formation of the 181-well Adena field in neighboring Morgan County, but Art Jersin, conservation director, says "it's too early to determine the efficiency of this flood," which began about a year ago.

The Willard flood . . . Production at Willard had dropped from a monthly high of 5,822 bbl. in April 1952 to a low of 393 bbl. in December 1956. Fifteen months after water injection began, output climbed to 2,100 bbl. in December 1957.

The pool was discovered in October 1951, and three other producers were completed on a 20-acre pattern before the limits of the field were defined.

Initial production varied from 98 to 230 bbl. daily of 38°-gravity oil. Early in the life of the field, one well began producing considerable water and was shut in.

One well was recompleted as an injection well, and more than 77,000 bbl. of water has been injected since the program began. As yet no injected water is being produced.

The D-sand formation is found at about 5,100 ft. Permeability and porosity are about average for the basin, and average pay thickness in the field is about 13 ft.

Adena field . . . Operators are also closely watching the results of the water flood at Adena. Jersin said that "several wells are beginning to show injection water, but it may be a year more before the final results are in."

Adena is the largest field in the Denver basin and the first ever unitized under Colorado's conservation commission. This flood is expected to add about 30,000,000 bbl. to the 40,365,000 bbl. originally expected to be recovered by primary means. This would push ultimate recovery to a little more than 50 per cent of oil in place (OGJ, June 10, 1957, p. 67). Pure Oil Co. is operator of the Adena unit.

Big Pipeline Growth

shown in detailed report by NPC. More lines planned.

THE NATIONAL Petroleum Council added up our domestic oil transportation facilities this week and found them impressive.

Pipelines in Districts 1-4, as of last September 30, had a capacity of 7,471,000 bbl. of crude and 1,575,000 bbl. of products.

The NPC report was prepared at the request of the Interior Department. It was based on a year's study of the various methods of moving oil, other than by ocean tanker.

The report pointed out that at the time of the study several pipelines were building. These included the Texas-New Mexico and Four Corners pipelines, the Tecumseh line, all for crude, and the Little Big Inch conversion, the Laurel system, and the Wabash line for products.

Pipelines by districts . . . The principal pipeline movements of crude are from producing areas in Districts 2 and 3 to refineries in the Mid-Continent and Gulf Coast areas and marine terminals on the Gulf Coast.

Some 4,140,000 bbl. daily capacity exists from producing areas in District 3 to Gulf Coast refineries and terminals, and 1,221,000 bbl. to Mid-Continent refineries. There is a capacity of 1,373,000 bbl. from District 2, supplemented by receipts from Districts 3 and 4, to Great Lakes refineries and 737,000 bbl. to Wood River plants.

The report indicated that the greatest network of product lines is found in District 2. The major movements within the district are from refineries in the Oklahoma-Kansas area to the North Central states and lower Great Lakes areas with daily capacities of 458,000 and 271,000 bbl., respectively. Lines out of District 2 have a total capacity of 118,000 bbl. daily to Districts 1 and 3 and the international boundary. Those entering have a capacity of 478,000 bbl. daily from Districts 1, 3 and 4.

Pipelines in District 5 had a capacity of more than 600,000 bbl. daily of crude from the San Joaquin Valley area. Capacity from the coastal fields was 328,000 bbl., and from the Los Angeles Basin 642,000 bbl. daily.

Incoming products lines had a capacity of 53,000 bbl., while lines within the district had a capacity of more than 725,000 bbl.

Also included in the report are figures on railroad tank cars, tank trucks, barges, and small lake tankers.

Tubing stretch mill, Youngstown, Ohio. Electronically controlled mill to be completed during second quarter of 1958 . . . will provide increased production for Tubing comparable to our increased capacity for Casing. Both Upset Finishing Mill and this facility will greatly augment our existing No. 1 and No. 2 Seamless Mills in Youngstown. Photo shows mill building under construction.

NEW MILLS FOR BIGGER MARKETS

Two years ago, ground was broken for our three new seamless Pipe facilities. The express purpose of this massive expansion program was to make YOUNGSTOWN'S production capacity and seamless pipe product mix conform to the future needs of the Oil and Gas Industries. These seamless pipe facilities are now integrated with your demands. This means you can look to YOUNGSTOWN for a full line of Oil Country Tubular Goods without limitations as to size, grade or finish in Drill Pipe, Casing, Tubing and Line Pipe!

QUALITY YOUNGSTOWN SERVICE

YOUNGSTOWN

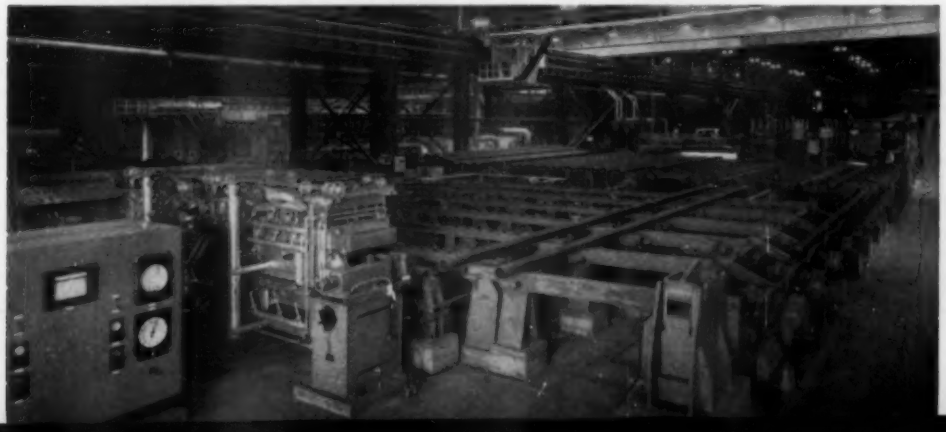
SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steels

Youngstown, Ohio

No. 3 seamless mill, Indiana Harbor, Indiana. Fully automated, ultra modern mill . . . began operating September 30. Contains world's largest Rotary Billet Heating Furnace . . . adds to our over-all capacity in both alloy and carbon casing. Offers API casing in sizes 4½", 5", 5½" and 7", in grades H-40, J-55, N-80, in ranges 2 and 3 . . . plus line pipe in sizes 4½", 5⅝" and 6⅝" O.D. in grades A, B, X-42, A106, A53 in single and double random lengths. Photo shows Rotary Furnace in foreground.

Upset finishing mill, Youngstown, Ohio. Also a fully automated mill began operations September 15. Contains a pair of automatic upsetters with attendant furnaces plus a full-length normalizing furnace for highest quality control of all products. This mill adds to our capacity for Drill Pipe in grades D, E, x-95 and in Upset Casing (Speedtite). Photo shows upsetter and control panel in foreground, normalizing furnace in left rear.



1958 Models Require Better Fuel

Compression ratios are up; horsepower has been increased

Year	No. Makes	No. Models	Std. Compression Ratio — Average	Highest	Lowest	Average — Displacement	Maximum brake hp.	RPM at max. hp.	Lb./hp. (Sedan)
1958	18	50	9.47	10.5	7.8	325.4	258.6	4,534	15.80
1957	19	47	8.96	10.0	7.2	309.9	236.7	4,594	16.08
1956	19	50	8.55	10.0	7.2	296.7	206.8	4,402	19.07
1955	19	53	7.96	9.0	7.2	270.7	173.1	4,279	22.05
1954	19	55	7.64	8.7	6.8	267.1	150.8	4,015	24.88
1953	19	54	7.44	8.5	6.7	256.6	133.0	3,861	27.06
1952	20	60	7.18	8.0	6.6	249.5	122.1	3,802	29.45
1951	21	62	7.07	8.0	6.48	247.7	116.2	3,745	30.35
1950	20	64	7.03	8.0	6.48	245.3	110.9	3,681	31.60
1949	20	56	6.88	7.8	6.3	249.5	111.8	3,660	31.70
1948	20	57	6.73	7.5	6.3	247.6	108.7	3,659	32.60
1947	19	53	6.68	7.25	6.3	248.8	107.8	3,624	32.70

Competition, Detroit Pushing Refiners

GASOLINE QUALITY is still improving, in spite of the economic pressure on refiners.

What's more, competition among refiners and pressure from car makers will force still further upgrading of octane ratings.

Ethyl Corp.'s monthly survey of gasoline quality for February shows an increase of .1 octane in the national weighted average of both premium and regular gasoline.

The premium average is 98.5 octanes and regular 91.1. Premium is up 1.2 octanes over a year ago, and regular is up .7.

The survey indicates heavy competition within the industry for higher octane ratings. Here is the evidence:

... **The number of cities** with 98 octane premium gasoline rose from 44 in January to 47 in February. Ethyl tests 57 cities.

... **The octane value** of third grade, or superpremium, gasoline continues to rise. Forty samples averaged 101.56, compared with 101.44 for 37 samples in January.

... **Premium gasoline** of more than 100 octane showed up in central Michigan for the first time.

... **A nation-wide high** of 99.5 for premium was set in metropolitan New York. Of 11 samples taken in New York, two were over 100.

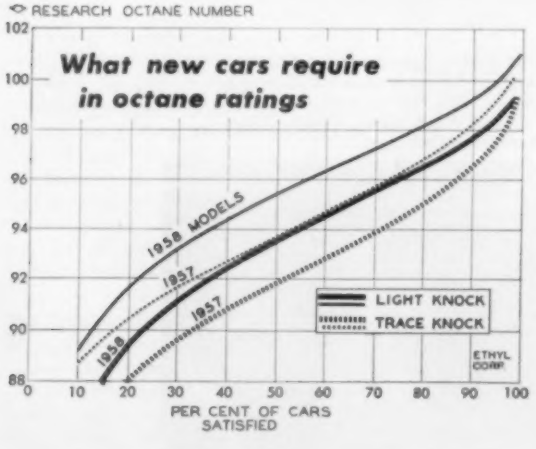
... **Three other cities**—Baltimore, Boston, and Richmond—had octane averages of 99.4. Last month only Baltimore, among the 57 cities tested, had a rating this high.

The new models . . . Ethyl has issued two other reports showing the unrelenting pressure for higher-quality gasoline. They deal with compression ratios and horsepower.

For only the second time in history, the average compression ratio for new models went up more than half a point. The 1958 models have an average ratio of 9.47 to 1, compared with 1957's 8.96 to 1.

The gain comes on the heels of two other gains of similar magnitude. In the past 3 years the gain has been 1.51.

The Ethyl report on horsepower



THIS CHART shows the gasoline quality required to satisfy 1958 cars, compared with that required by 1957 models. It shows, in general, that 1958 models demand gasoline two octane numbers better than did the 1957 models.

"Light knock" refers to a knock which is barely audible to the average motorist. It is not harmful to the engine. "Trace knock" is audible only to an expert. For completely knock-free operation, a car owner must use a gasoline with an octane rating one-fourth to one-half a number above the "trace knock" level.

Note, for example, that a 94-octane gasoline was sufficient to provide knock-free operation in 50 per cent of the 1957 cars produced, but to satisfy half of the 1958 cars requires a gasoline of almost 96 octane rating.

Viewing the chart another way, 94-octane gasoline would fully satisfy more than 50 per cent of the cars in 1957, but only 35 per cent of the 1958 cars.

shows that 1958 models have nearly 2½ times as much horsepower as the new models did 11 years ago. Also displacement has grown a third.

The average for 1958 is 258.6 hp., compared with 236.7 a year ago and 107.8 in 1947.

It is significant that 11 of the 19 makes of 1958 cars have one or more models in the 300-hp. class. Among them is Plymouth's Golden Commando, one of the "low-priced three." Ford has an option on the Fairlane with a special 10.2-to-1 compression ratio that is rated at 300 hp.

The tendency of Detroit to really pour on the power has been consistent for the past 4 years. The 1958 increase of 21.9 hp. is, actually, the smallest of the four.

What it means . . . What the 1958 models mean to the refiner is important. Ethyl calculates it will take nearly 2 octanes more to satisfy 50 per cent of the 1958 models than it did the same fraction of the 1957's.

This is even more significant when the refiner considers that added processing to get another octane on top of today's 98.5 premium average is far more costly than it was when the average was 86.6 a decade ago.

However, the industry was prepared for the 1958 models. The 98.5 average is good enough to satisfy the "light knock" requirements of about 92.5 per cent of the new cars. The best of the beefed-up premiums and the third-grade superpremiums on the market today will easily meet the requirements of all the new models.

But there is still not much hope for a respite in the octane race. One of the brakes on motor-car advancement has been the fact that the Pacific Coast trailed the rest of the country on octane ratings. But that has changed. Tidewater Oil Co. has introduced 100-octane gasoline into the area. Others are expected to follow.

In the past Detroit was reluctant to ship its high-requirement cars to the far west, but the attitude of the manufacturers could change now. Not only can they sell high-requirement cars throughout the country, but they also can jump compression ratios and horsepower with full knowledge that the fuel will be there to meet the more critical needs.

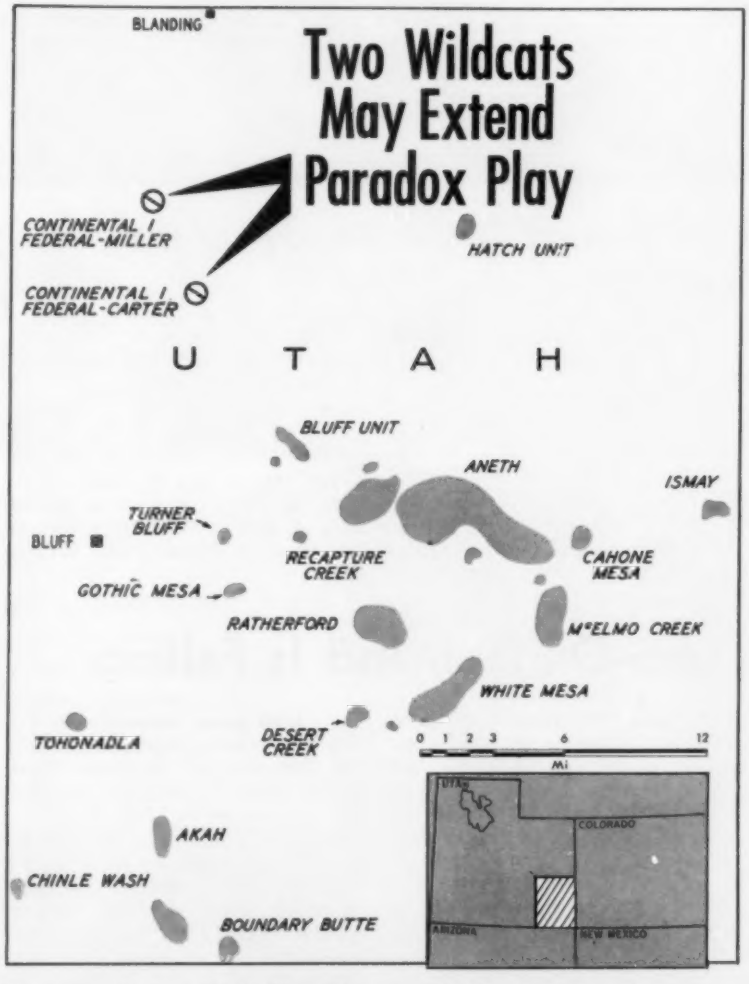
Ethyl's 50-City Study

PREMIUM

Group—	Feb. 1958	Jan. 1958	Feb. 1957
94-94.9	1	1	4
95-95.9	0	3	1
96-96.9	3	1	18
97-97.9	6	8	18
98-98.9	35	31	12
99-99.9	12	13	0
Total cities	57	57	53
Wtd. avg. RON	98.5	98.4	97.3
Wtd. avg. ml./gal.	2.57	2.51	2.47

REGULAR

Group—	Feb. 1958	Jan. 1958	Feb. 1957
83-83.9	0	0	1
84-84.9	1	1	0
85-85.9	0	0	1
86-86.9	0	1	7
87-87.9	2	1	4
88-88.9	11	11	7
89-89.9	16	15	13
90-90.9	6	7	3
91-91.9	6	6	9
92-92.9	9	9	8
93-93.9	6	6	0
Total cities	57	57	53
Wtd. avg. RON	91.1	91.0	90.4
Wtd. avg. ml./gal.	1.86	1.91	2.02



Supertight Wells Cause Stir in Rockies

CONTINENTAL Oil Co. has set pipe at two supertight wildcats in San Juan County, Utah, that have the industry buzzing.

Reports circulating in the Rockies say both wells are producers. If so, they would extend Paradox basin production from 8 to 14 miles northwest. No official information is available, however.

The wells are the Continental 1 Federal-Miller, 14 miles west of Hatch Unit production; and Continental 1 Federal-Carter, 8 miles northwest of Bluff Unit production.

The company is keeping tight lipped on the wells because of the acreage situation. The Carter well, at least, lies just off open Indian land; and Continental apparently is trying to avoid publicity until the next Ute lease sales.

First Asphalt Tanker Ready for Duty

THE MORANIA ABACO, first ship designed exclusively to handle asphalt, will start carrying hot asphalt to Atlantic and Gulf of Mexico ports this month.

The new vessel, which has a 16,000-bbl. capacity, will move asphalt from American Bitumals & Asphalt Co.'s plants at Baltimore and Mobile, Ala. American Bitumals is a subsidiary of Standard Oil Co. of California.

The ship is equipped with two heating coils to keep the asphalt in a liquid state. The asphalt will be taken aboard at 350° F.

Primarily designed for "hot" voyages of 3 to 5 days, the tanker will be able to make voyages up to 15 days. It is equipped with an auxiliary boiler and is rigged so that outside steam could be used in emergencies.

The ship is 264 ft. long, 47 ft. wide, and 18 ft. deep, with double-wall, all-steel construction. Owner of the vessel is Morania Oil Tankers Corp.

Lube-Oil Demand Is Falling

AS THE FRB INDEX goes, so go lubes. That's a common comment of petroleum economists. And developments are bearing them out.

The Federal Reserve Board index of industrial production reached its postwar high in 1956. Postwar demand for lubes also peaked that year. The index has been going down since—so has demand for lubes.

One reason for this is that industry uses a lot of lube oils and greases. Some 45.3 per cent of all lubricating oils and 35 per cent of greases go into industrial uses.

Data on lube uses are given in the API-sponsored Bureau of Census study of lubes. The study, first since 1951, covers 1956 and shows that:

... **Total lube sales** in 1956 were 54,746,990 bbl., including exports of 12,626,990 bbl. They went into these uses: Automotive, 28,454,969 bbl.; aviation, 1,501,118 bbl.; and industrial, 24,790,903 bbl.

... **Total grease sales** were 4,684,926 bbl., including exports of 667,099 bbl. They went into these uses: Automotive, 3,040,916 bbl.; aviation, 3,629 bbl.; and industrial, 1,640,381 bbl.

One thing that has hurt lube-oil sales is the reduction in crankcase capacities of automobiles. Twenty years ago some capacities were as high as 10 to 12 qt. An arithmetical average of all models in 1938 was just under 6.6 qt. Ten years ago the average was 5.45, and last year it had dropped to 4.84 qt.

Aviation lubes represent a small and declining portion of total demand. For one thing, the Air Force is going in more for synthetic lubes for jet planes. With jets taking over both in military and civilian aviation, the prospect is that the demand for petroleum-based lubes in this field will tend to drop.

Exports are important in the lube picture. Historically they have represented 20 to 30 per cent of total demand.

But there are already 38 refineries in Western Europe that produce lubricants, and capacity is on the increase. It is also on the increase in Latin America, which has been a growing market for U. S. products. Creole Petroleum Corp. is adding a lube unit to its huge refinery at Amuay, and Petroleos Mexicanos plans to add lube capacity to its refinery at Minatitlan on the Gulf of Campeche.

The softening domestic demand and growing ability of other countries to meet their own requirements account for a lessening interest in lubes. There has been little recent change in U. S. lube capacity. January 1, 1956, it was 186,000 bbl. per day; a year later, 191,000; and now, 196,000.

Pipeline Charge

filed by U.S. claims tariff based on valuation is illegal.

THE JUSTICE DEPARTMENT charged last week that the payment of dividends to shipper-owners of oil pipelines on the basis of valuation rather than investment is an illegal rebate.

The charge was raised in a brief filed in the District of Columbia Federal Court where three cases of alleged violation of the 1941 Elkins Act consent decree are pending.

The companies under attack are Arapahoe Pipe Line Co., Tidal Pipe Line Co., and Service Pipeline Co. A fourth case, against Texas Pipe Line Co., was settled last month by a consent order.

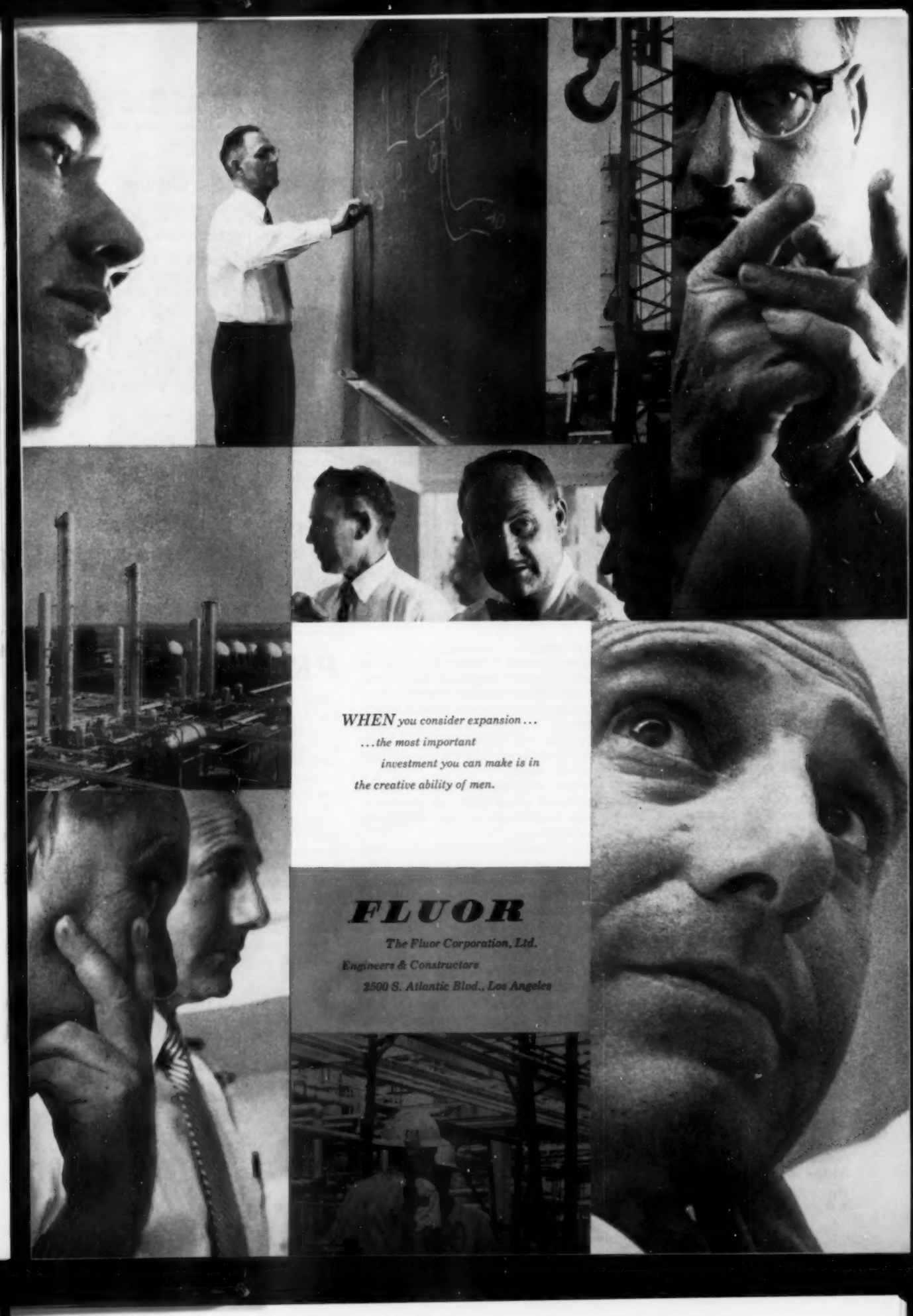
The argument . . . The department's brief, dealing with the Arapahoe case, cited that the company issued 2.9 million worth of capital stock to its shipper-owners in 1954 and by 1956 had borrowed $26 million.

The Government charges that dividends, limited to 7 per cent by the 1941 decree, were based on the $28.9 million valuation but should have been based only on the $2.9 investment.

"Arapahoe's owners are paying the tariff with one hand and pocketing a rebate with the other," the court was told.

Twelve other pipelines, also operating on borrowed capital, are taking limited part in the case and will be affected by its result.

The department contends that by basing dividends on the entire valuation of their properties the actual return to shipper-owners of pipelines has ranged from 16.4 to 10,047 per cent.



WHEN you consider expansion . . .
. . . the most important
investment you can make is in
the creative ability of men.

FLUOR

The Fluor Corporation, Ltd.
Engineers & Constructors
2500 S. Atlantic Blvd., Los Angeles

Weather Cuts Stocks

. . . of products by biggest amount in 13 years. But they're still high, and price cuts are still worrying producers.

THE LONG SIEGE of cold weather over much of the nation resulted last week in the greatest drawdown of petroleum product stocks since World War II.

Volume of products in storage tumbled by 12,240,000 bbl. during the week and marked the third straight week of heavy drawdowns. Stocks were reduced by 8,204,000 bbl. the week before.

The trend was good news for oil men, forced to cut back field production and reduce refinery runs to keep the surplus from becoming so great it would break both crude and product prices.

However, the drawdown still left stocks 35,000,000 bbl. higher than they were at this time last year. There were still bright prospects that this will be reduced further. More cold weather is predicted for March. Effects of the refinery cutbacks are yet to be felt. Bulk of these reductions came too late to be reflected in current statistics.

Nature of the product movements clearly showed that freezing weather was the cause. Distillates dropped 11,749,000 bbl. for the week; kerosine 1,891,000 bbl., and residual 1,699,000. Gasoline offset these drops with a 3,099,000-bbl. increase, reflecting a sharp decline in highway travel during the winter onslaught.

The cold weather also benefited the LPG industry. One big LPG producer reported that propane underground storage has been practically depleted during the last few weeks. Only propane working stocks now are available, although butane stocks are still on hand.

This should mean a healthy situation for the LPG industry. Low stocks will firm prices and keep production facilities busy this spring and summer refilling storage.

Price picture . . . Oil men still are worried about crude prices and watched the supply-demand balance closely to gage results of recent production cutbacks.

Only two areas felt new price cuts: South Louisiana and the Four Corners.

Magnolia Petroleum Co. adjusted price for crude and condensate for Cameron Meadows field in Cameron Parish, South Louisiana. Only a small volume of oil was involved.

Magnolia trimmed the Cameron Meadows crude price by 15 cents per barrel by shifting it into another schedule with a top posting of $3.27. At the same time the company adopted a flat price for condensate of $3.20 a barrel. It has been buying condensate on a gravity scale calling for $3.48 a barrel for 34° gravity and above.

El Paso Products Co., gatherer of much of the crude being moved in the Four Corners Pipe Line Co. to California refineries, cut its postings by 15 cents a barrel. New postings start at $3 a barrel for 40° gravity and above. Initial postings for the area had a $3.15 top.

Other price changes were only adjustments to meet prices of competitors. Cities Service posted new prices in Texas and Oklahoma areas. Anderson-Prichard Oil Corp. followed the lower trend in southern Oklahoma. Col-Tex Refining Co. cut 15 cents a barrel for crude in parts of Howard and Mitchell counties, Texas.

The cutbacks . . . Oklahoma joined the other prorated oil states by whacking back allowable production for March.

The Oklahoma Corporation Commission ordered a 44,000-bbl. daily cutback. The order will result in daily production of 504,000 bbl., just about what purchasers said they could take for the month.

The Oklahoma cut was an across-the-board affair with all producers, even water-flood projects, taking the reductions.

As a result of the Oklahoma action, March production will be down 638,455 bbl. daily in four big producing states. Earlier Louisiana cut 48,140 bbl. daily for March, Texas 540,687 bbl., and New Mexico 5,628 bbl.

Several refiners in Oklahoma, Kansas, and California announced they were reducing runs. One small California refiner, Fletcher Oil Co., even shut down its 5,000-bbl. plant at Wilmington. At least four other refiners in the state were considering a similar move.

The serious oversupply problem in California was fast developing into a major industry crisis. Contract cancellations have hit small producers hard in Huntington Beach and Signal Hill fields of the Los Angeles Basin and the Belgian anticline and Raisen City fields in San Joaquin Valley.

California production last week fell to 886,000 bbl. daily, an 8-year low. Production cutbacks recently have totaled about 45,000 bbl. daily.

Alberta Bids Down

for March. Both U. S. and Canadian nominations dip.

THE AILING DEMAND for Alberta crude oil took another body blow when refiners submitted March nominations to the Alberta Oil and Gas Conservation Board.

Only 311,591 bbl. daily were nominated—a drop of 55,908 bbl. daily from the February figure and 92,584 bbl. less than the demand in March 1957.

Manitoba and British Columbia are the only two Canadian provinces seeking more crude in March than in February. These increases are small. Saskatchewan's requests are down 6,765 bbl. daily, and Ontario's decreased by 23,800 bbl.

Refiners in the U. S. Midwest nominated 11,968 bbl. daily, a drop of 6,439 bbl. Western U. S. refiners also cut nominations from 40,536 bbl. daily in February to 35,861 bbl. in March.

PROCESSING

The Texas Co. will build a 7,500-bbl. Udex unit at its 60,000-bbl. refinery at Wilmington, Calif. Construction will begin in May and completion is scheduled next February. Ralph M. Parsons Co., Los Angeles, has been awarded the engineering contract.

API's Department of Technical Services has published a two-volume "Handbook on Degree-Day Data." The handbook was prepared by the API panel on degree-day forecasting in cooperation with the U. S. Weather Bureau. Dr. F. C. Roop, Standard Oil Co. (Ind.), is chairman of the panel.

Oriental Refining Co., Denver, has been sold to Flank Oil Co., Billings, Mont., for a reported $6 million. Max Zall, Oriental vice president, said the sale included the firm's 3,500-bbl. daily refinery at Denver, 1,000-bbl. daily refinery at Alamosa, Colo., all marketing facilities, and crude-oil production.

Present officers of Oriental will retain some interest in the company. E. M. Stringer, president of Oriental,

First Four-Way Well

. . . completed by Magnolia. Three gas zones are producing through tubing, fourth flows up through casing annulus.

MAGNOLIA Petroleum Co. is laying claim to the world's first quadruple completion.

The company has established gas production from three parallel 2⅞-in. tubing strings and from the 7⅝-in. casing annulus in the same well. The producer is the 8 Santa Cruz Farms in the San Carlos field of Hidalgo County, Texas.

Advantage of a quadruple completion to Magnolia obviously is that it gets four wells for very little more than the price of one. As a result, low productivity zones which otherwise would not be commercial can be produced at a profit.

How it works . . . Triple completions with three parallel tubing strings are no novelty on the Gulf Coast.

Magnolia used basically the same down-hole arrangement already proved for these triples. The fourth zone of production was added simply by perforating a zone above the topmost packer of what otherwise would have been a three-string, three-packer triple.

Magnolia picked a good well on which to try out the quadruple-completion idea. The four zones:

. . . Are closely spaced in the hole.

. . . Have pressures nearly the same.

. . . Are in a straight hole, not deviated.

. . . Are gas producers only.

The Texas Railroad Commission has consistently opposed triple completions involving any oil production. Chief reason is the danger to the oil reservoirs in case of down-hole communication. Triple completions involving gas, however, have been allowed.

Gas has been gaged from each of the four zones in the Magnolia well, and tests show no communication between zones.

Producing sands in the 8 Santa Cruz Farms are at depths of 7,024-30 ft., 7,455-95 ft., 7,533-60 ft., and 7,629-49 ft. They are separated by packers at 7,437 ft., 7,505 ft., and 7,615 ft.

Each of the lower three sands flows up through its own tubing string, the top zone flows out the annulus. Shut-in pressures vary from 2,675 to 3,150 psi., and flowing pressures on ½-in. chokes run from 2,050 to 2,550 psi.

Getting on production . . . The bottom packer was a Baker-retainer type set on a wire line in the 7⅝-in. production casing.

The first string of 2⅞-in. tubing carried the two other packers with a Baker triple-flow tube connecting them. The second and third strings were run in sequence and latched into the flow tube. Each string was tested to 4,500 psi.

The tubing strings were hung in a special universal-type hanger and then the tree was tested to 5,500 psi. No leaks showed, and there was almost no difficulty in running tubing string and in installing the tree.

Mud in the hole was circulated out with water through circulating sleeves in the tubing string. Only one of the zones required swabbing before coming on production.

BRIEFS

will continue in a management capacity. The managing director of Flank Oil is Thomas Brook of Calgary.

The first LPG underground storage in the Steelman area of southwestern Saskatchewan will be developed in conjunction with a $20,000,000 natural-gasoline plant northeast of Estevan. The plant and storage facilities are being built by Steelman Gas, Ltd. Anchor Petroleum Co., Tulsa, will develop a new marketing area for the propane when the plant is completed in September. The plant will process about 25,000 M.c.f. daily. An estimated 20,000,000 gal. of propane will be produced the first year.

The Texas Co. is studying a proposal from a group of Montana businessmen to take over operation of the company's 8,000-bbl. refinery at Sunburst, Mont. Texaco had planned to dismantle the plant next year when the company's new Anacortes, Wash., refinery goes on stream.

The group, representing Toole, Glacier, Liberty, and Pondera counties, proposes to continue operation at Sunburst to take care of 160,000 bbl. of surplus crude monthly which would result from abandonment of the refinery. Texaco officials indicated there was merit in keeping the refinery on stream as an outlet for oil in the four counties, including Texaco production.

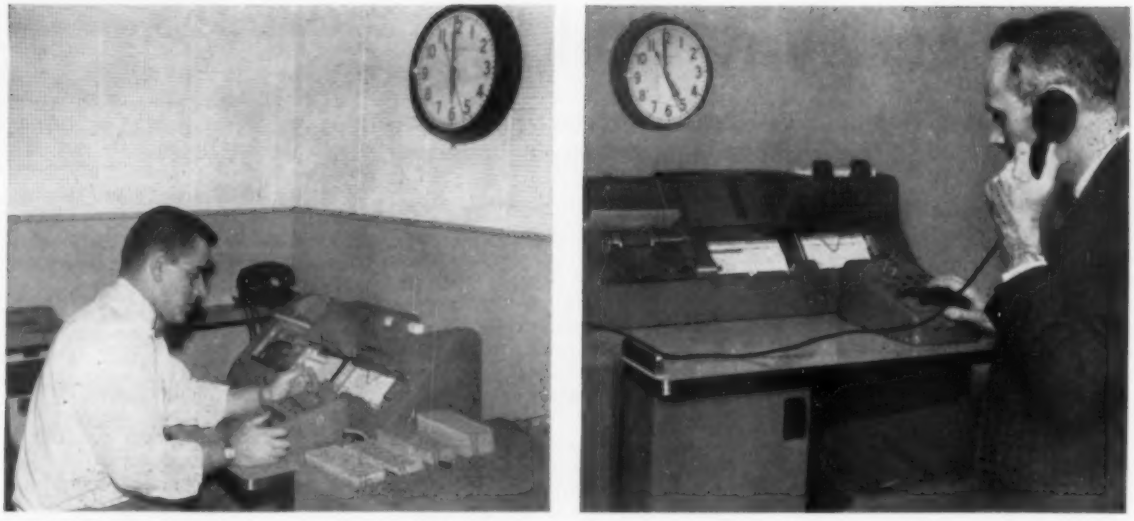
Ethyl Corp. has launched a nationwide sales and advertising program to promote more car driving. Designed to increase sales of all service-station products, the program is called the "magic circle." This is Ethyl's fourth consecutive year of promoting motor-fuel sales.

Du Pont has announced a new gasoline additive to prevent carburetor icing. The product consists of dimethyl formamide and is called DMF Antistall Additive. Less than a teaspoon per gallon does the trick, according to Du Pont.

Also for Refiners . . .

IN THE NEWS: The industry now knows what OCAW's bargaining goals are for 1958: Wage hikes, longer contracts, greater protection against layoffs (p. 63) . . . New approach—building from models—has permitted Bay Petroleum to put cat reformer on stream in jig time (p. 64) . . . Refiners are still pushing octanes up and the pressure is for even more quality improvements (p. 76) . . . Cold weather helps refiners with postwar record drawdown of stocks. Effects of production and refinery cutbacks are still to be felt (p. 81) . . . Esso Standard has a new trick for computers. Data from Baton Rouge refinery is sent by transceiver on telephone lines to Linden computer (p. 82).

PLUS THESE TECHNICAL REPORTS: How gasoline plants are using gas chromatography (p. 88) . . . Engine wear measured while you wait (p. 91) . . . Where are petrochemicals headed? (p. 95) . . . New ways to minimize corrosion in amine plants (p. 100) . . . An approach to solids waste disposal in the refinery (p. 125).



OPERATOR at Esso Research in Linden works after hours to take data on transceiver from Baton Rouge man who starts sending computer data when Esso refinery offices close, Louisiana time. The money-saving system means . . .

Computers Do Double Duty Via "Telephone"

TWO HEADS are better than one. This goes for "magic" brains, too.

Two Standard Oil Co. (N.J.) affiliates are using leased telephone lines to link computers located at Baton Rouge, La., and Linden, N. J. The trick is done with transceivers.

Esso Standard's Baton Rouge refinery has kept an IBM 705 "business" computer in operation continuously for 2 years. The computer, however, has its limitations, and engineers needed another. An IBM 704 installed at Esso Research & Engineering Co.'s computer center at Linden, N. J., more than 1,100 miles away, would fill the bill nicely.

The transceivers bridge the gap and make it possible for the Linden computer to do part of Baton Rouge's work. Baton Rouge engineers put math problems and refinery process data on IBM cards. The cards are fed into a transceiver by the company telephone operator, who flips a switch and feeds the data directly to the Linden transceiver, card by card.

At Linden, the cards are fed to the computer, which grinds out the solution. Baton Rouge then gets the solution back via the Esso Research transceiver.

The transceivers "read" cards at the rate of 40 per minute. They convert the data into a distinctive signal, which is then translated back to punched cards at the receiving end. The transceiver reads each column of an IBM card in sequence, and this is reproduced almost simultaneously at the other end.

The computers do their "talking" to each other after office hours, when the leased telephone line is free.

Problems received at Linden normally are computed the following day. Depending on the urgency, the solution may be telephoned back to Baton Rouge, returned by wire the following night, or airmailed.

Bob Hardy, who coordinated the project, cites an example of the time saved. Operators can feed to Linden in 15 minutes a complex gasoline blending problem. It takes the 704 computer at Esso Research about 1 hour to complete the 60 to 70 simultaneous equations involved. In case of urgency, the Linden computer could give Baton Rouge the solution in less than 2 hours, over a distance of nearly half a continent.

Oil Blamed for Subsidence

NEW EVIDENCE that oil production is responsible for subsidence in California's Wilmington field was released last week in a study started more than 8 years ago.

The study shows that in at least three of the field's zones—Tar, Ranger, and Upper Terminal—the casing and liner have buckled slightly and shortened. Some 40-ft. sections of 8⅝-in. casing and 6⅝-in. liner have shortened as much as a foot.

There is no evidence of similar pipe damage opposite nonproducing zones in Wilmington field wells.

The buckling occurred opposite producing zones because the loss of pressure from production resulted in greater pressure from above.

The Long Beach Harbor Department hired Long Beach geologist Jan Law in 1949 to make the subsidence study. Law devised a unique "collar-counter" to measure liner and casing lengths downhole. This electronic device is lowered into the hole on a wire and emits a "blip" as it passes a joint. The length of wire between "blips" is compared with the original length of pipe to determine any shrinkage.

Law completed the study and turned his report to the Harbor Department in 1950, but it was not made public at the time. Frank Hardesty, chief petroleum engineer for the department, explained the delay by saying the study showed only "indications" and needed further checking.

Subsequent checks on Law's work were made in 1954 and 1957, and confirmation of the findings is contained in a special 51-page report submitted to the Harbor Department last week by engineer L. B. Brock.

Both Brock and Law said that where flooding maintained pressures there was virtually no compaction and compression.

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

385 Madison Avenue New York 17, N. Y.

NEW LUMMUS DELAYED COKER FOR SOCONY MOBIL WILL CHARGE 19,000 B/D

Project scheduled for completion in early 1959

Socony Mobil has chosen Lummus to design, engineer and construct a 765 ton-per-day delayed coker for their Paulsboro, New Jersey, refinery.

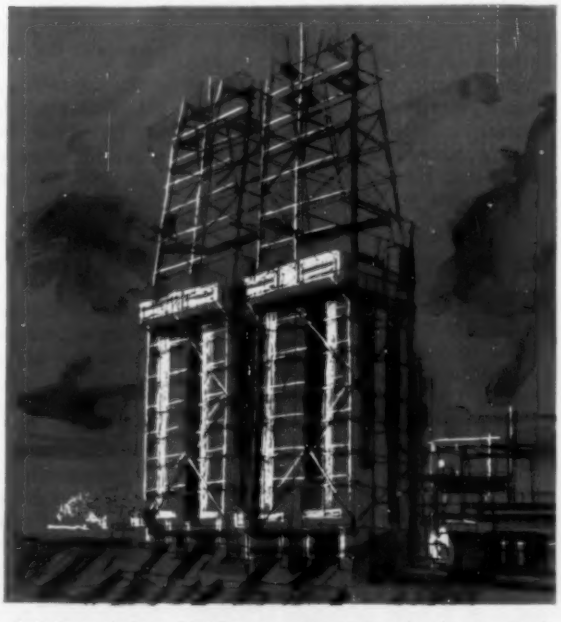
The equipment is being designed for 19,000 barrels per day of charge composed largely of heavy mixed residual tars, supplemented with heavy vacuum gas oil stocks. Products will include — in addition to 765 tons of coke per day — dry gas and hydrogen sulfide, butane and butylenes, light and heavy gasoline, and light and heavy oil.

This installation will contain two separate coking heaters for greater flexibility, and four coke drums measuring 19 feet by 63 feet tangent to tangent. Other facilities include sections for fractionation, dehexanization, gas recovery, hydrogen sulfide recovery, coke handling, and related utilities.

This installation, when completed in early 1959, will bring the total of cokers designed and built by Lummus to 11, with a combined coke producing capacity of 5,000 tons per day, over ⅓ the overall total yielded in the United States.

When you plan a new facility — or a complete refinery—Lummus can put 50 years of experience, on more than 700 plants throughout the world, to work for you.

The Lummus Company, 385 Madison Avenue, New York 17, N. Y. *Engineering and Sales Offices and Subsidiaries:* New York, Houston, Baton Rouge, Montreal, Caracas, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Washington, D. C. *Engineering Development Center:* Newark, N. J.



Artist's rendering of 765 ton-per-day delayed coker for Paulsboro, N. J., refinery of Socony Mobil.

Sahara Tracts Awarded

. . . to non-French firms, but French interests own at least 50 per cent. Phillips, Cities Service get concession shares.

THE FRENCH moved over last week to make room for U. S., British, and Dutch oil hunters in the Sahara Desert of Algeria.

The price of admission to North Africa's shooting gallery for the outsiders is just about $18 million. For this they get a chance to help develop what may be the world's next big oil province. They also get to join the French as targets for rifles in the hands of Algerian nationalists.

After a wait of 6 months, Paris has moved officially to award new exploratory concessions in the desert region of Africa that has produced two promising oil fields—Hassi Messaoud and Edjele—in the last 2 years. The French Government awarded new acreage to seven companies. Two are American, one is British, two are French, and the Royal Dutch-Shell group has a part of two companies.

The seven were awarded concessions totaling 28,600 sq. km. and agreed to spend just under $18 million looking for oil. Eleven companies had filed applications for a total of 148,300 sq. km. The conflicting applications for acreage made maps of the region look like a multicolored patchwork quilt.

Each of the outsiders will go into the Sahara with one or more French partners. Paris insisted that each applying company be at least 50 per cent French-controlled. Reports last week indicated that a third American-French combine in which Sinclair Oil Corp. and Newmont Mining Corp. have an interest will be awarded acreage soon.

The awards . . . Here are the awards made to date:

. . . Cie. des Petroles d'Algerie (CPA) received 2,700 sq. km. in two permits called Hassi Keskes and Oued Metlili. The company has agreed to spend a minimum of $1,620,000 in exploration during the 5-year term of the permits. The Royal Dutch-Shell group holds a 65 per cent interest in CPA. The company already has been carrying on an extensive exploration program in the Sahara.

. . . Cie. de Recherche et d'Exploitation de Petrole au Sahara (CREPS) also received 2,700 sq. km., but in a single permit called El Hobre. The company must spend at least $1,620,000 on exploration. The Royal Dutch-Shell group owns 35 per cent of CREPS. This company made the Sahara's initial oil discovery at Edjele in the extreme southeastern region of the country near the Libyan border. CREPS is now developing Edjele and two more field discoveries, Tigourentine and Zarazatine, in the same region.

. . . Petroles de Valence was awarded the Oued Nsa permit covering 4,600 sq. km. and must spend a minimum of $2,760,000 exploring the tract. British Petroleum Co., Ltd., and one of its French affiliates own 50 per cent of this operation.

. . . Phillips Petroleum Co. France, along with Petroles France-Afrique and Omnirex, received two permits, Hassi Touareg and El Morr. The permits cover a total of 3,300 sq. km. The group must spend at least $2,220,000 exploring.

. . . Cities Service Co.'s French affiliate, Prepa, and Francarep got three permits named Hassi Melah, Hassi el Hadjar, and Oulougga. The three total 6,400 sq. km. The American-French group must spend $3,840,000 on the permits in the next 5 years.

. . . Ste. Nationale des Petroles d'Aquitaine got the 7,700 sq. km. permit El Barour. The company, already active in metropolitan French exploration, must spend $4,620,000 in its Sahara search.

. . . Petrosarep, controlled by the French oil family, Nahmias, got the smallest permit awarded. It is the 1,200 sq. km. Erg Foukani permit. Petrosarep must spend at least $720,000 on the lease. Another of the Nahmias family companies, Petro REP, made the first oil discovery in France's Paris Basin last week (see p. 85).

Pipeline picture clouded . . . Meanwhile, the Sahara pipeline picture became further confused.

The French concede now that the planned 24-in. line from Hassi Messaoud to the Algerian port city of Bougie can't be built for at least 2 years. And there are reports that construction plans for the line have been dropped altogether because of Algerian rebel activity and lack of French funds.

A second proposed Sahara pipeline, promoted by Bennie Bender of Shreveport, has taken on a new look.

Bender, just returned from talks with French and Libyan officials, told the Journal last week that the projected 18-in. trunk, extending from Hassi Messaoud to Edjele field and northeast through Libya to Tripoli, is no longer planned as a French-owned project.

The line has now evolved, he said, into a common carrier to be owned jointly by the French, American interests, and the Libyan Government—each holding a one-third interest.

The Libyan Government, he said, is in sympathy with Algerian nationalists and will not go for a French-owned line crossing the country.

Bender said he cleared one major hurdle when he acquired a transcontinental easement from the Libyan Government for the Libyan portion of the right-of-way.

The Louisianan said he still faces some obstacles, however, and that it likely will be another month before he knows for certain whether the line will be built.

Despite the changed ownership picture, the line itself remains as initially proposed (OGJ, Jan. 6, p. 87). Design calls for an initial capacity of 100,000 bbl. daily. The project would include two tank farms at Hassi Messaoud and Tripoli, a tanker-loading terminal at Tripoli, and a microwave system. Cost is estimated at $40,000,000.

Russia Plans Record Drilling

THE RUSSIAN oil industry plans to drill a record 23,896,000 ft. of hole in 1958 and to increase the number of rigs in operation to 1,000.

This year's goals include 12,176,000 ft. of exploratory drilling and 11,720,000 ft. of development drilling. The 1957 goal was 8,577,000 ft. of exploratory and 10,004,000 ft. of development drilling.

Russian drilling footage showed little gain from 1950 through 1956. While both development and exploratory drilling are rising sharply, 1958 will be the first time in recent years that exploratory footage exceeds development work.

Number of rigs working simultaneously fell from 1,220 in 1954 to 740 in 1956, but is increasing again.

French Test Opens Paris Basin

A PRIVATELY owned French company, drilling its first wildcat, lifted the hopes of oil-hungry France last week with a new discovery almost in the backyard of the nation's capital.

Ste. de Recherches Petrolieres dans la Region Parisienne (Petrorep) recovered 50 bbl. of crude on a 75-minute drill-stem test at the Coulommes 1. Whether or not Coulommes turns out to be a commercial field, there is little doubt that the test is the most important find in France since Parentis 4 years ago.

The wildcat, the first discovery in the big Paris Basin, is 27 miles east of Paris and 5 miles southeast of Meaux near the center of the basin. The basin covers most of north-central France, and most of it is already under license or applications are pending.

The flow in the test came from a 66-ft. pay section at 6,060-6,126 ft. The crude is 44.5°-gravity, with very little sulfur content. The source is the Dogger section of the middle Jurassic lime which produces light crude extensively in West Germany. Porosity was 15 per cent, and permeability was described as good.

The area . . . Petrorep will take the wildcat to 10,000 ft. Possibilities for deeper pay in the middle and lower Jurassic and the Triassic were described as good. Location of the test is on an anomaly found by a seismic survey and confirmed by core holes.

C. G. Carlson, Tulsa consulting geologist and adviser for Petrorep, said the structure is 12 miles long and about 6 miles wide. He said the company plans to follow up the success immediately with another test on the structure or elsewhere on the company's 1,588-sq. mile concession.

Shows have been found in other wells in the basin, but none were commercial. Nearest dry hole is 27 miles southeast at Courgivoux where another company went below 10,000 ft. This well had shows of light oil in the middle Jurassic.

About 75 miles northwest of the new strike, several wells were drilled on the Bray anticline where the upper Jurassic comes to the surface. Some heavy oil was found but the wells were abandoned after producing too much water.

The company . . . A local marketing and shipping company, Petrofrance, has 51 per cent interest in Petrorep. The Rothschilds and other French investment trusts own the remaining 49 per cent. Petrofrance is owned by three brothers, Marcel, Eli, and Joseph Nahmias.

The firm is one of four private companies exploring in France without some government participation. The concession was obtained in 1956, and drilling began last October, after 15 months of preliminary work. Forenco, French drilling contractor, used brand new American equipment for the test.

——World briefs

Standard - Vacuum Oil Co. has started a two-phase program to boost the crude capacity at its Altona refinery in Australia by 25 per cent. First phase involves substantial improvements throughout the plant which will raise its capacity from 32,000 bbl. daily to 41,000 bbl. The second phase calls for construction of a Sovafiner. Engineering work on both projects has been started by Fluor Corp., Ltd. Both units are slated for completion some time next year.

A new desulfurization unit has gone on stream at the 118,000-bbl. La Mede refinery of Cie. Francaise de Raffinage, the largest refinery in France. M. W. Kellogg designed and built the unit to remove 85 per cent of the sulfur from 12,500 bbl. daily of a 80/20 blend of virgin gas oil and light catalytic cycle oil. Cobalt-Molybdate catalyst is used in the reactor.

Russia claims to have made commercial discoveries of "high-quality oil" in southern Moldavia near Vulkaneshty, with production scheduled to begin the second half of this year. Soviet reports state that exploration in other parts of the Moldavian Republic "has also yielded results."

A new UOP Platforming-Unifining unit is on stream at the Deutsche Erdoel-Aktiengesellschaft refinery at Heide, Germany. The unit, which includes gas concentration facilities for producing LPG, is designed to handle a blend of Arabian and Heide crude. The Unifining unit is serving as a pretreater for the Platformer. Initially operating at a 2,000-bbl. capacity, the Platformer eventually will be stepped up to design capacity of 4,000 bbl. Construction was by Procon (Great Britain), Ltd.

Japan's first combination UOP Platforming-Unifining unit, with capacity of 1,500 bbl., has gone on stream at the Yokohama refinery of Asia Oil Co., Ltd. The Unifining section is processing naphtha from Middle East crudes. Japan Gasoline Co., Ltd., licensing agent for Universal Oil Products Co. in Japan, built the unit.

Oesterreichische Mineraloel-Verwaltung, A.G., oil agency of the Austrian Government expects to step up natural-gas deliveries to 100,000 M.c.f. daily this year. The agency recently opened a new gas treating plant at Auersthal field.

World Production Gains

. . . for first time since June. Middle East at new all-time high. U. S. climbs after 3-month drop.

FREE-WORLD crude production picked up in December to end a decline that had gone on since mid-1957.

The year-end rise was due to a new all-time high in the Middle East. The United States gained after 3 months of sliding. Venezuela was down slightly from November, but Canada showed a small gain.

None of the major Middle East producers set individual producing records. But across-the-board gains resulted in a peak.

Arabian American Oil Co. passed a milestone when it produced its three-billionth barrel. Only four other countries besides Saudi Arabia have done so—the U. S., Venezuela, Russia, and Iran.

The West German figure is abnormally high because it includes crude recovered from Georgedorf 98, which blew wild for several days last year when the field's repressuring project went wrong. About 200,000 bbl. was salvaged, cleaned up, and ready for shipment to refiners in December.

TREND OVER THE LAST YEAR

	Western Hemisphere less U. S.	Middle East	Total, Free World outside U. S.
1956			
Dec.	3,916.3	2,430.3	6,992.4
1957			
Jan.	3,933.9	2,645.7	7,301.7
Feb.	4,040.7	2,855.5	7,561.6
Mar.	4,117.8	2,764.3	7,582.0
Apr.	4,111.5	3,140.0	7,985.0
May	4,116.0	3,556.1	8,407.3
June	4,160.6	3,957.3	8,872.5
July	4,076.2	3,989.4	8,824.7
Aug.	3,924.5	3,955.0	8,649.6
Sept.	3,759.6	3,969.5	8,504.6
Oct.	3,758.8	3,878.9	8,435.5
Nov.	3,643.6	3,704.2	8,131.8
Dec.	3,645.5	3,993.6	8,410.1

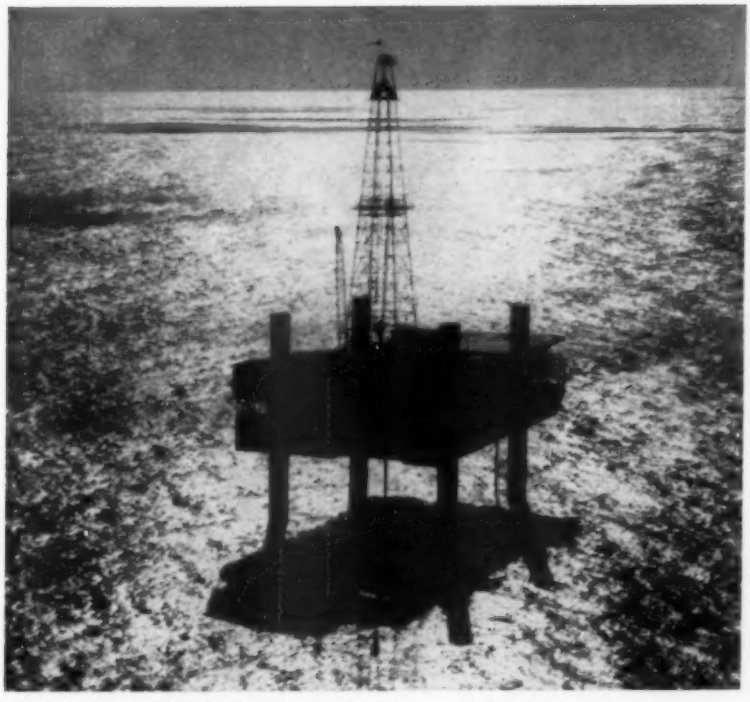
World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	December 1957	November 1957	December 1956
Western Hemisphere			
Argentina	96.2	96.2	93.0
Bolivia	10.0	10.0	9.2
Brazil	30.9	30.9	24.7
Canada	413.0	409.9	537.5
Chile	13.7	13.1	10.6
Colombia	127.6	125.7	124.7
Cuba	1.0	1.2	1.1
Ecuador	9.2	9.2	9.2
Mexico	253.6	253.6	249.6
Peru	52.1	52.1	51.1
Trinidad	96.3	97.0	84.0
Venezuela	2,541.9	2,544.7	2,721.6
Total	3,645.5	3,643.6	3,916.3
Europe			
Austria	57.2	57.2	64.6
France	27.2	26.9	28.5
West Germany	85.4	79.0	71.3
Italy	21.7	21.7	17.5
Netherlands	30.0	31.5	24.6
Turkey	6.2	6.2	6.1
United Kingdom	1.6	1.6	1.5
Yugoslavia	7.6	8.0	6.4
Total	236.9	232.1	220.5
Middle East			
Bahrain	34.3	33.1	30.1
Iran*	731.0	712.0	520.0
Iraq†	628.6	604.4	219.5
Israel	1.2	1.2	1.2
Kuwait	1,276.1	1,107.0	823.8
Neutral Zone	100.0	90.0	27.9
Qatar	169.1	142.7	117.5
Saudi Arabia	1,053.3	1,013.8	690.3
Total	3,993.6	3,704.2	2,430.3
Other Asia			
British Borneo	118.0	118.0	117.9
Burma	9.2	9.2	5.0
India	8.5	8.5	9.2
Indonesia	320.0	338.0	262.2
Japan	6.5	6.3	6.1
New Guinea	5.6	5.6	7.1
Pakistan	5.9	5.9	5.8
Total	473.7	491.5	413.3
Africa			
Algeria	0.2	0.2	0.4
Egypt	53.6	53.6	10.0
Gabon	5.1	5.1	
Morocco	1.5	1.5	1.6
Total	60.4	60.4	12.0
Free World			
Foreign	8,410.1	8,131.8	6,992.4
United States	6,929.0	6,824.0	7,377.0
Total	15,339.1	14,955.8	14,369.4
Communist Countries in Soviet Orbit			
Romania	220.0	220.0	218.0
Russia	2,070.0	2,050.0	1,600.0
Others	50.0	50.0	50.0
Total	2,340.0	2,320.0	1,868.0
WORLD TOTAL	**17,679.1**	**17,275.8**	**16,237.4**

*Includes estimated 5,000 bbl. daily from Naft-i-Shah field not operated by consortium companies.

†Includes estimated 3,600 bbl. daily from Naft Khaneh field, operated by British Petroleum Co.

Figures are from reliable industry reports or official government sources. Data for Communist countries in the Soviet Orbit, which includes the European satellites and Red China, are based on competent estimates. Authentic information is not available on month-to-month production in these areas. Estimates also were made where complete reports are lacking.



NEW BARGE drills wildcat in new Middle East concession as . . .

Persian Gulf Fleet Grows

THIS SELF-CONTAINED little wor'd, silhouetted in the sunset, could easily be a drilling barge in the U. S. gulf. It's not. It's located in the far-away waters of the Persian Gulf.

But U. S., Persian, or any other gulf, twilight is the time of day when an offshore outfit can look most lonely against an open expanse of sea. The crew on this barge, the Adma Enterprise, faces a winter night with temperatures sinking to near freezing. Even the base camp 20 miles away was built on desolate, uninhabited Das Island.

The Adma Enterprise recently spudded the Adma F-1, the first wildcat on a concession held by Abu Dhabi Marine Areas, Ltd. British Petroleum Co., Ltd., has two-thirds interest in the venture, and Cie. Francaise des Petroles, one-third (OGJ, Jan. 13, p. 71).

The next outfit to reach the Persian Gulf will be a light LeTourneau mobile rig ordered by Aramco. A Dutch tug has left the Netherlands for New Orleans, where it will pick up the 800-ton outfit for the 9,600-mile tow to Ras Tanura.

Shell Oil of Qatar has a 1,900-ton barge on order.

More Drilling in Europe Urged

WESTERN EUROPE has taken a penetrating look at itself as possible oil country and found the picture may not be as dark as it once believed.

An energy importer for the last 30 years, Europe had just about become resigned to a future dependent on higher and higher volumes of imported oil to keep its industrial economy on the move.

Then 2 years ago the 17-nation Organization for European Cooperation made some energy studies for the future. At this time the predicted costs in foreign exchange for keeping the region's industrial machine oiled brought a fiscal shudder.

The findings of those studies caused some soul searching by the oil committee of the OEEC. Last week, in a 76-page report covering 19 countries (Spain and Yugoslavia in addition to the OEEC members), the searchers reached some conclusions. Here they are:

. . . **More intensive exploration** of Europe is needed to develop local oil sources that haven't even been scratched.

. . . **37.6 per cent** of Western Europe is covered by sedimentary basins which offer prospects of oil accumulations. The committee has broken this down into two classes which it groups as "rather favorable" (23.3 per cent) and favorable (14.3 per cent).

. . . **Vast areas** almost entirely unexplored in these two classes are located in southeastern and southwestern Europe.

The committee got some unexpected support for its position just a few days after its report was published. An apparently good discovery in the big and previously unproductive Paris basin in France excited the French oil world (See p. 85).

The committee pointed out that in 1956 member countries of the OEEC supplied a modest 210,000 bbl. daily of their oil needs, plus an additional 580,225 M.c.f. of gas daily. This was only about 12.6 per cent of consumption.

By normal increases in production the OEEC believes this could be increased to about 20 per cent of production in 1975. At the same time, however, the increased needs of imported oil will cost $5.2 billion in foreign exchange.

To help bridge that gap locally, the committee recommends that all OEEC countries do everything in their power to promote increased oil exploration at home. They also advise cooperation between member nations in exchanges of information on the work done and results obtained.

In short, the committee says prospects of finding new oil in Europe's big sedimentary basins are "bright."

Petrochemicals for Trinidad

W. R. GRACE & CO. is working on plans for a fertilizer plant to be built in Trinidad. The basic unit will be a synthetic anhydrous ammonia producer using hydrogen derived from locally-produced natural gas. Its capacity will be on the order of 100 tons per day.

Grace will also produce ammonium sulfate for local consumption within the British West Indies Federation. Synthetic urea will be produced for markets in the general Caribbean area, mainly for banana plantations.

A new company, Federation Chemicals, Ltd., will be formed to operate the $16-million plant. In addition, Grace is understood to be planning to invest 7 million BWI dollars in other chemical facilities. About 20 per cent of the investment in the fertilizer facilities will be by UK investors.

FIELD PROCESSING

How gasoline plants are using

GAS CHROMATOGRAPHY

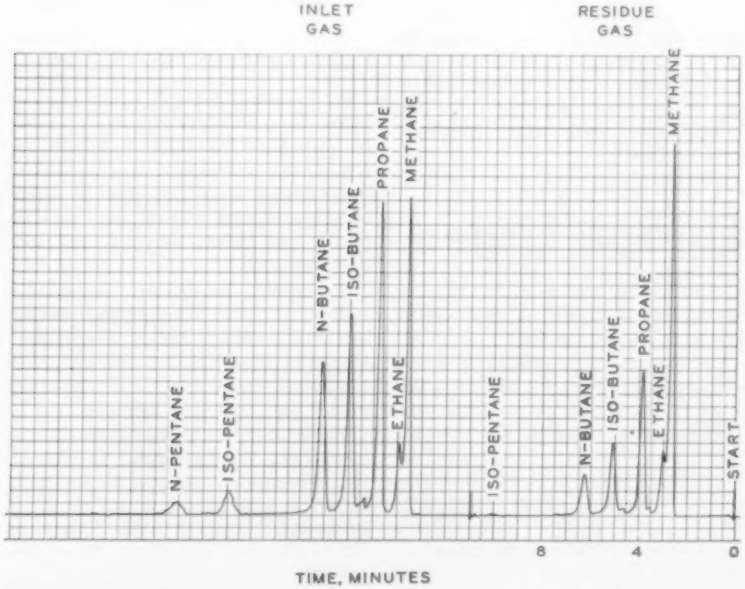
Phillips discovered it could keep tab practically up to the minute on plant recovery efficiency and observe the effects of even small changes in operating variables, such as weather temperatures.

BY A. J. **MILLER**, Phillips Petroleum Co.

IN ADDITION to its promising role as a laboratory analytical method, gas chromatography is rapidly proving its value in plant applications and as an engineering tool. At relatively low cost, knowledge of stream composition, sometimes involving only small variations, may be obtained in many cases with speed and reliabilty heretofore unavailable.

Chromatographs are valuable for a number of applications in natural-gasoline plants. Percentage recovery figures on key components, usually the basis for plant-performance guarantees and always of much value in studying plant efficiencies, can be determined rapidly and reliably. New plants can be started up and lined out in a much shorter time and probably at higher efficiency than otherwise as numerous spot checks can be made to achieve optimum adjustment of operating variables and to compare performance with design calculations or guarantees.

Process-stream chromatographs can be used to automatically monitor concentrations of critical components, including trace impurities, in plant products or intermediate streams. The fact that these instruments speedily separate and measure individual components of a sample greatly enlarges the possibilities of onstream analyzers for monitoring and control. The signal for a specific component can be converted into a means of automatically controlling process variables to hold the concentration of the component within given limits.



ABSORBER EFFICIENCY TESTS can be run in 24 minutes, 12 minutes each on inlet and residue gases. Fig. 1.

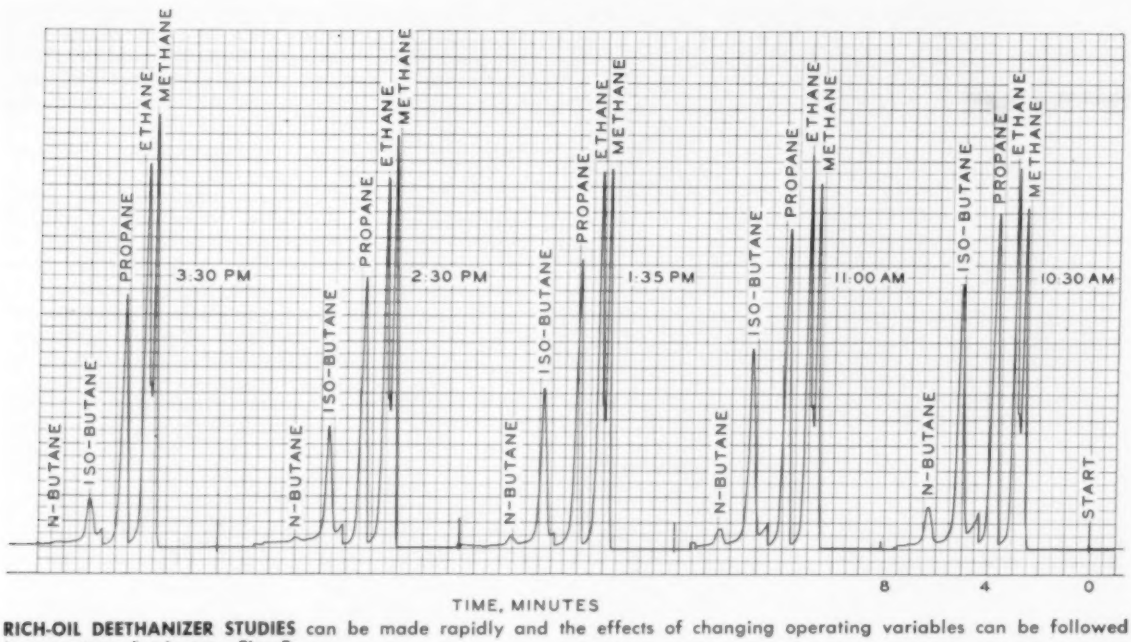
Plant tests . . . A few months ago, Phillips placed in operation some natural-gasoline absorption facilities in an isolated location in South America. Lack of analytical facilities hampered performance testing needed to insure achieving top efficiency. Validity of design calculations for recoverable production was questionable because of the change of field conditions after design information was obtained.

We decided to give chromatography a try and an instrument was shipped to the plant. For calibration purposes, an absorber inlet and a residue-gas sample were shipped from the plant to the United States, analyzed, and returned.

After 2 or 3 weeks of experimenting, we found we could keep tab practically up to the minute on plant recovery efficiency and observe effects of even small changes in operating variables and other conditions such as weather temperatures. This was due to the speed of analyses, convenience of taking the very small samples needed, simplicity of the routine analysis and calculations, excellent reproducibility, and high sensitivity of the instrument.

Absorber studies . . . The absorber is perhaps the key unit in a natural-gasoline plant, in that inefficient operation at this point means that no matter how well the rest of the plant is operating, over-all efficiency will be poor.

Fig. 1 shows a spot check on absorber efficiency that was completed, including sampling, analyzing, and calculating in about an hour. The infor-



RICH-OIL DEETHANIZER STUDIES can be made rapidly and the effects of changing operating variables can be followed in a matter of minutes. Fig. 2.

mation obtained included per cent absorption on propane, isobutane and normal butane, and detection and identification by components of trace losses of pentanes and heaviers into the residue gas. The chromatograms shown for the absorber inlet and residue were run in about 12 minutes each.

Considerable previous experimentation with the chromatograph variables were required for selection of the column packing material, column length, carrier-gas rate, temperatures, etc., to obtain the required separations speedily. The poor separation between methane and ethane was accepted in this instance in favor of speed since, for this purpose, the concentrations of these two components were of no significance.

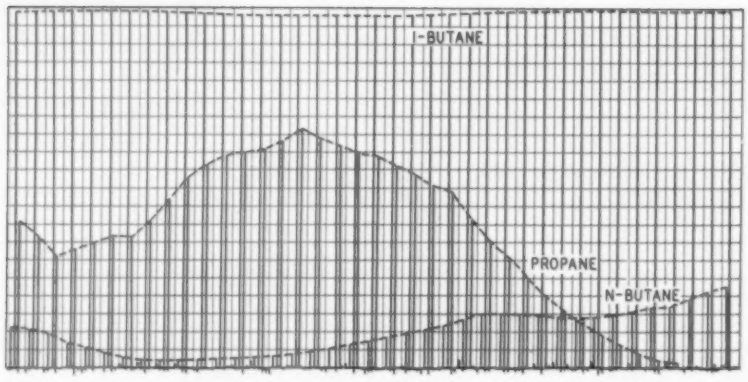
The symmetrical and sharp peaks for propane and the butanes allowed quick computation of per cent absorptions by direct comparison of the peak height of the inlet component with that of the corresponding residue component. Correction for absorption shrinkage, of course, was made. This direct comparison method eliminates the need for calibrations, standards, and area computations.

This method proved consistent and reliable. Table 1 presents results of a series of spot checks on one absorber. Absorption temperature was the major cause of variations, and the test results reflected this as closely as could be expected from equilibrium value relationships. Here is a comparison of the two March 9 test results with respective NGAA "K" values:

	Propane	i-Butane	n-Butane
Ratio per cent absorbed	$\frac{27.4}{20.6} = 1.33$	$\frac{54.6}{40.5} = 1.35$	$\frac{75.4}{56.2} = 1.34$
Ratio of "K" values*	$\frac{.680}{.530} = 1.28$	$\frac{.335}{.245} = 1.37$	$\frac{.245}{.185} = 1.32$

*120° and 95° F., 400-psia, pressure.

AUTOMATIC ON-STREAM ANALYZER was constructed in Phillips instrument shop. This instrument monitors propane and n-butane content of a stream of isobutane. Fig. 3.



CONTINUOUS RECORDS MADE over a 6-hour period with automatic on-stream analyzer, with programer set for cycle analyses each 10 minutes. Fig. 4.

TABLE 1—PER CENT ABSORPTIONS
(Based on Comparing Inlet and Residue Chromatograms)

Date—	Time	Propane per cent	i-Butane per cent	n-Butane per cent
March 7	7 a.m.	29.8	57.8	79.9
	3 p.m.	21.1	43.4	61.9
March 8	7 a.m.	28.9	55.7	78.6
	2 p.m.	20.7	39.5	57.1
March 9	9 a.m.	27.4	54.6	75.4
	2 p.m.	20.6	40.5	56.2
Average all results		24.8	48.6	68.2
Design calcs., average conditions		24.3	50.0	66.9

With proper care in sampling and running of comparative samples in close sequence under the same instrument conditions, the **relativity** of results is highly dependable for practical plant testing, such as to evaluate the effects of operating changes.

The first few days of such tests revealed unsuspected variations in one absorber performance, and correlation of data with spot checks pinpointed the cause, which was corrected. Then by trial and tests, optimum distributions of gas and absorption oil were achieved for the complex system of high and low-pressure absorbers for maximum over-all recovery. A worthwhile increase was immediately reflected in the plant production records.

Trace quantities . . . The chromatograph is very sensitive to trace quantities of gasoline components and absorption oil in a residue gas stream. It is vastly superior to any previous method, both in the accurate determination of such traces and in the speed and facility of the analysis. This provides the gasoline-plant operator and engineer with a very valuable tool since even trace losses of valuable components soon represent many dollars, especially in large-gas-volume plants.

An important plant variable relating to trace losses is the lean-oil stripping, controlled by the stripping steam rate and other still conditions. It has long been a problem, because of limitations of test methods and calculations, to set still conditions without risking either losses due to understripping or unnecessary operating costs due to overstripping. The speed and sensitivity of the chromatograph permits direct measurement of absorber overhead losses as stripping is gradually lowered, or increased, until most economical operations are attained.

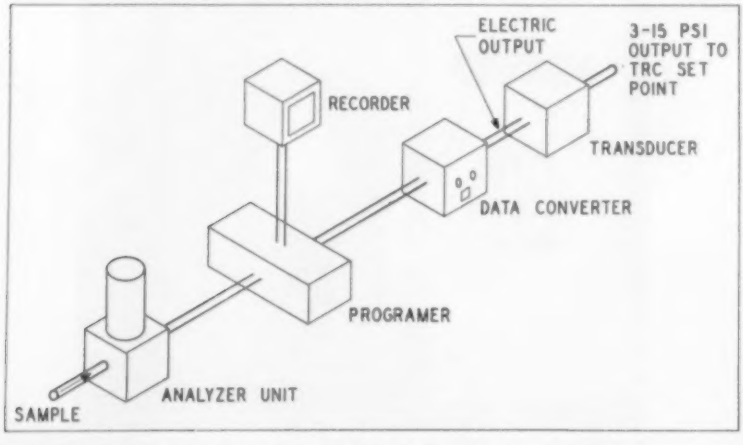
The South American tests resulted in savings in stripping steam, which was put to use to very good advantage elsewhere in the plant. The small pip of isopentane shown in the residue gas, Fig. 1, represents 0.01 mole per cent of this component. This was determined in work to ascertain minimum stripping conditions.

Deethanizer studies . . . The function of the rich-oil deethanizer in a gasoline plant is to reduce the methane and ethane in the rich-oil to within acceptable limits with least loss of propane and heavier.

This involves optimum adjustment of a number of operating variables in both the bottom or stripping section and the top or absorption section, such as temperatures, pressures, absorption-oil rate, stripping-medium rate, and tray entry. Although calculations are usually adequate for design purposes, there are often factors not properly accounted for in the design data that warrant establishing operating conditions by testing of actual operations. With a chromatograph available at the plant, the effects of changing operating variables can be followed in a matter of minutes.

Fig. 2 shows a series of such analyses on samples taken to evaluate results of efforts to minimize the propane and butanes in the rich-oil deethanizer overhead. The saving accomplished is shown by the progressive decrease in peak heights of these components in five successive samples covering the period from 10:30 a.m. until 3:30 p.m. Such relative results are of much value in guiding plant operations and can be obtained by simply comparing peak heights of components in samples run under identical analytical conditions. Absolute values may be obtained by comparisons to standards.

Other streams . . . There were a number of other plant streams on which chromatographic analysis proved quite helpful. Among these were the plant



PROCESS CHROMATOGAPH equipment block diagram for automatic control use. Fig. 5.

products for specification and quality data information, particularly when we were adjusting product fractionator operation in efforts to increase capacity.

Those examples illustrate several important advantages for chromatography: (1) low cost and simplicity of instruments permit wide use in plants (can also be moved from plant to plant for efficiency checking); (2) sensitivity and speed enables superior plant operating guidance; and (3) simplicity of analyses in routine use. This is so much so, in fact, that the sampling and analysis can be made automatic by use of a sequence timer or programer and this has now become an area of great interest in chromatography.

Instruments available . . . A number of instruments for on-stream analysis are commercially available and instruments for process control are in rapid development.

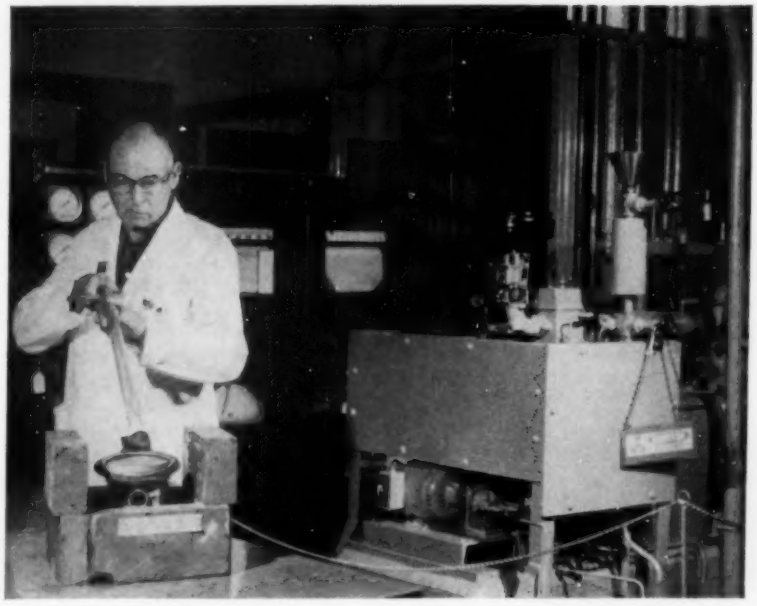
Fig. 3 is a picture of an automtic on-stream analyzer constructed in Phillips instrument shops. This analyzer contains three elements: (1) analyzing unit, (2) programing unit, and (3) recorder. Such an instrument was used in an application to monitor the propane and n-butane content of a stream of isobutane.

Fig. 4 shows the record made over a 6-hour period with the programer set for cycle analyses each 10 minutes. The chart drive, instead of running continuously, was automatically advanced a set distance between component peaks and stopped while the component was passing through the detector. This resulted in the bargraph presentation of data shown.

Instruments for a number of plant stream monitoring services are now in use by Phillips. Their use, in some cases, for automatic control is now under investigation. As shown by block diagram in Fig. 5, this is accomplished by use of a data converter and transducer to convert the analyzer output into a pneumatic signal for controlling a process variable, such as heat input.

Acknowledgments

The information in this article was developed cooperatively by a number of personnel of the natural gasoline department, foreign department, and research and development department of Phillips Petroleum Co. Particularly, J. H. Huddleson and R. H. Stone assisted with the Venezuela tests; Dan E. Smith furnished technical guidance relative to laboratory techniques; and B. O. Ayers furnished the information pertaining to process stream monitoring and control.



Engine wear measured while you wait

ENGINEERS and scientists at Shell Development Co.'s research center, Emeryville, Calif., can now tell you how much wear there is on your piston rings, cylinder walls, or both, during a single engine startup.

Using radioactive tracer techniques, it takes them only a few minutes to measure such engine wear. In 1 day they can gather information that would take more than a month without this modern aid. With this technique they can follow the wear of each or two rubbing parts simultaneously.

Using a steel cylinder sleeve and a chromium-plated piston ring that have been bombarded with neutrons, Shell scientists have developed a new technique using two different radioactive isotopes, one on each of two engine parts in moving contact. Microscopic pieces of metal that are worn off the cylinder sleeve during operation and are deposited in the crankcase oil contain radioactive iron-59 and those from the ring contain chromium-51.

Sensitive counter . . . These radioactive materials are counted individually by a scintillation counter that is 50 times more sensitive than a Geiger counter. The automatically recorded radioactivity present in the oil tells researchers how much wear there is on these two engine parts beginning with the first stroke of the engine. The counter is sensitive to quantities of radioactive material as small as 1 mg., that is, one one-millionth of a gram.

This new technique has several advantages over old analytical methods. In the past, a piston ring was carefully weighed and run in an engine for several days. The engine then had to be torn down, the ring removed and carefully cleaned and reweighed. The difference in weight told engineers how much ring wear had taken place under one set of driving conditions.

Using radioisotopes, the engine need not be torn down; much more accurate results are obtained and operating conditions may be changed while the engine is running. In addition, wear on either the ring or the cylinder, or both, can be studied by the technique.

This double isotope technique is also used to study other moving engine parts: gears, rocker arms, bearings, etc.

Everything's up to date at Panoma

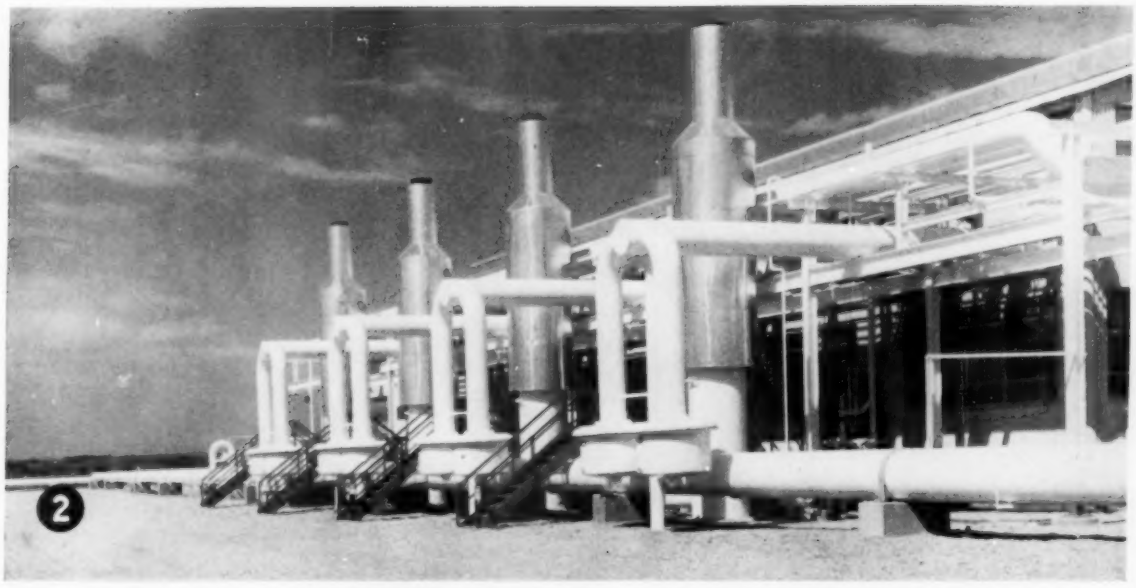
By BARRY HUNSAKER
El Paso Natural Gas Co.

RECENT ADVANCES in the design and construction of compressor station facilities by El Paso Natural Gas Co. are represented in the accompanying illustrations of its newly completed Panoma plant near McLean, Tex. These pictures show how the plant layout and operating efficiency has been improved by changing the design and construction of gas compressor stations.

The Panoma station is located in Gray County of the Texas Panhandle on El Paso's new 18-in.-20-in. line from its East Panhandle and West Panhandle gas fields, covering all or portions of Collingsworth, Wheeler, Gray, and Donley counties in Texas. This is an area of frequent cold weather during the winter time and severe dust storms.

THE PICTURES . . .

1 A T-shaped building under one roof houses the compressor units as well as the auxiliary equipment such as pumps, air compressors, water treaters, building heaters, etc. Also included in this building are the machine shop, warehouse, office, and control room. All equipment necessary and incidental to the operation of the compressor station is located within this one building, providing easier access to the various pieces of equipment by the operating personnel. In addition to the operating advantages, this design and construction is less costly than the previous method of compressor station construction wherein several isolated buildings were employed to house the equipment. Apart from the customary camp cottages, this one building houses the complete compressor station, and no other buildings are involved.



2 A general view of the gas piping side of the compressor building. The air cleaners are set away from the piping to facilitate access during maintenance operations. The starting air, cooling water, fuel gas, and other plant service piping are located outside of the building on pipe stanchions adjacent to it. Placing this service pipe outside of the building eliminates the need for a basement or pipe trenches in the building. The only piping beneath the compressor building floor are the compressor unit suction and discharge leads.

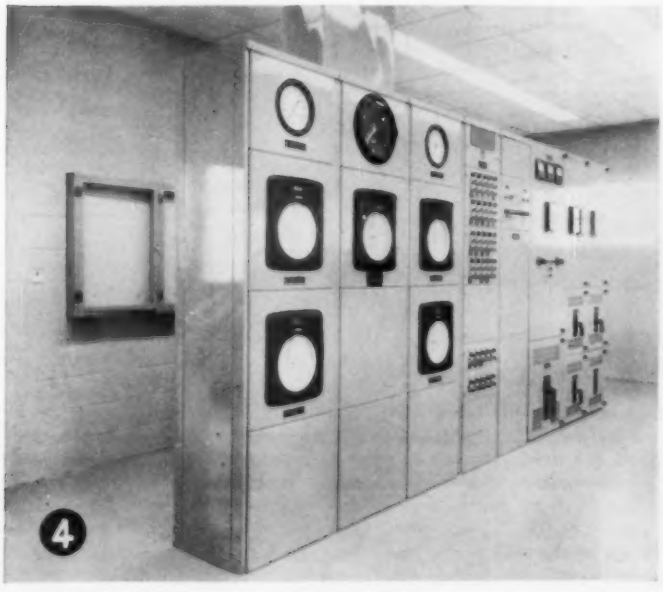
3 A view of one of the four Ingersoll-Rand 412-KVS 2,000-hp. turbocharged compressor units. Two oil filters are shown. The larger one on the left is a full flow waste type filter. The one to the right is a sidestream filter packed with fuller's earth. The oil cooler is mounted adjacent to the engine. The overhead piping (upper left) is the intake air piping to the turbochargers.

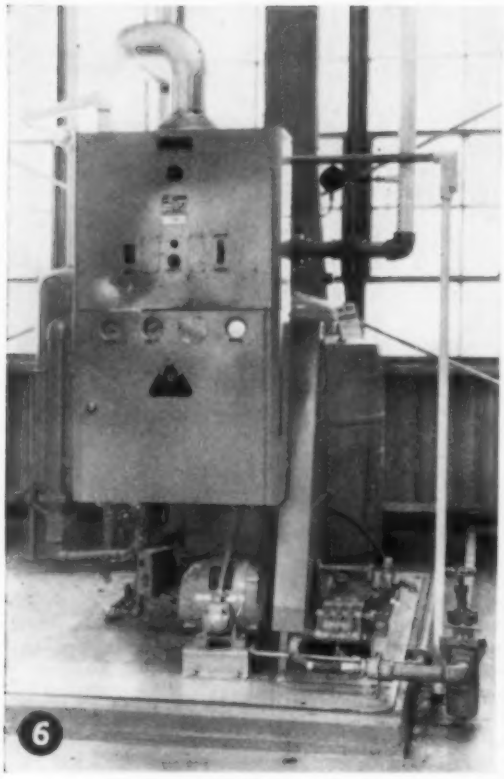
4 A view of the control panel in soundproofed and pressurized control room. This room adjoins the compressor room and isolates it from the auxiliary room to the rear. This room houses the station instruments, switch gear, and remote push-button starters for the station motor-control center.

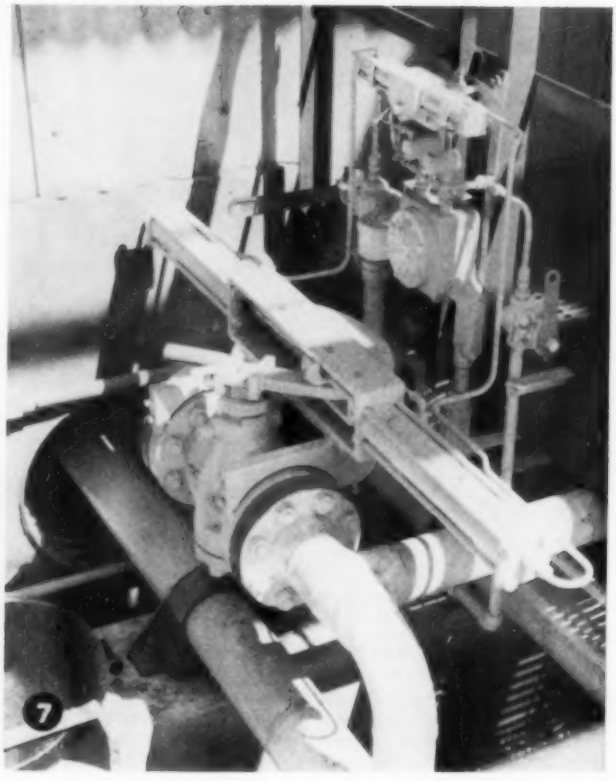
5 Engine console. Each individual compressor engine is completely controlled by the operator from these consoles which house all of those instruments, gages, etc., necessary and incidental to the operation of the engine and, in addition, switches for actuating the compressor unit suction, discharge, bypass, and vent valves. From these consoles one man is able to start the machines, operate the valves, load up the machine, and place it "on the line."

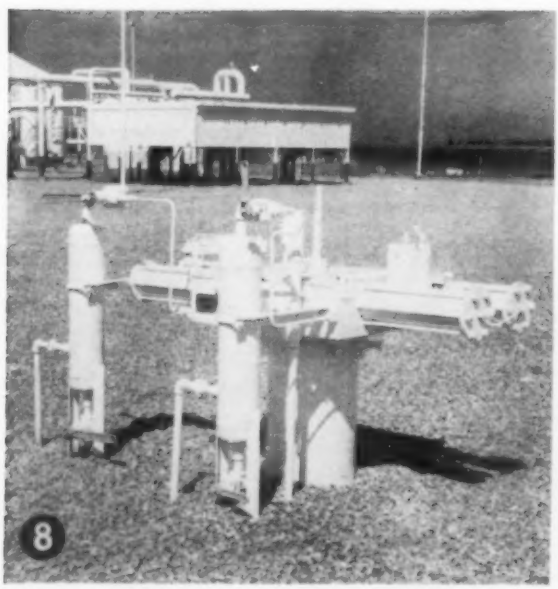
6 Compact steam generator for the building heating system.

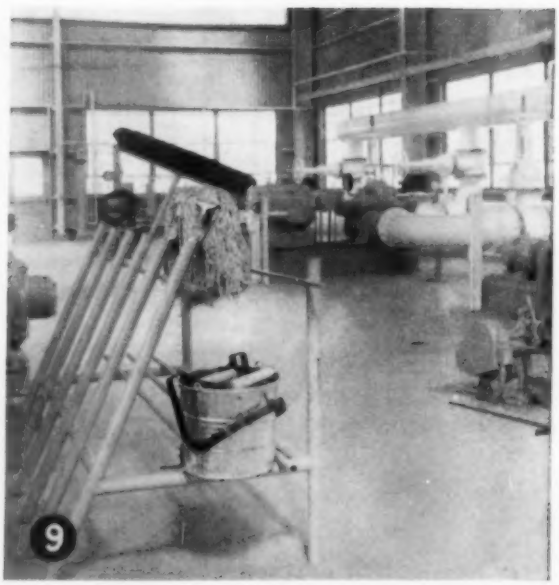
(Continued on next page)











7 Showing a unit bypass valve. Note the Ledeen gas-hydraulic valve operator. This operator is positioned by a pneumatic pilot actuator located to the right and above the operator in the photo. The pilot actuator is, in turn, controlled by an electric signal from the unit console shown in Photo 5.

8 Station block valve. This valve is operated by a Ledeen gas-hydraulic dual quad operator. This valve is tied in to the emergency-shutdown system to close when the station emergency-shutdown switch is actuated, after which all of the gas in the station piping is vented to atmosphere.

9 Interior of the auxiliary portion of the building. Note the mop rack in the foreground and the jack water pump in the background. The mop rack has been specially designed so that the mops and buckets can be kept in an orderly and convenient way.

Where are petrochemicals headed?

Here's a clue:

1930	1957	1965
0.14 billion pounds 1 per cent of total	38 billion (estimated) 26 per cent of total	85 billion (forecast) 40 per cent of total

. . . and here's some light on raw materials sources and costs

BY W. E. KUHN

IT IS ESTIMATED that petrochemical production will increase more than 100 per cent between now and 1965. About 50 per cent of the petrochemical raw materials are byproducts from refinery operations and the rest come from natural gas and LPG. Supplies of raw materials from all these sources should be adequate during the period under consideration. Costs of raw materials will increase due to increased costs of exploration and production and due to spot shortages created by competition for supplies of certain hydrocarbons. The rapid growth of a foreign petrochemical industry will reduce the export demand. Trends indicate that continued growth of the petrochemicals industry can be anticipated.

Petrochemical Growth

The rapid growth of the petrochemical industry is well recognized and is shown in Table 1.

TABLE 1—PETROCHEMICALS GROWTH

	Billion pounds per year	Per cent of total chemicals
1930	0.14	1
1955	32	24
1957 (estimated)	38	26
1962 (estimated)	62	31
1965 (estimated)	85	40

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The growth rate of petrochemicals is much greater than that of refined petroleum products and will require a slightly bigger slice of the crude as shown in Table 2.

Duplication . . . It is difficult to establish exactly the weight of crude as refinery byproduct being used as raw material for petrochemicals. In the manufacture of petrochemicals the refinery byproduct is increased in weight during processing by virtue of the addition of other materials such as oxygen, halogens, nitrogen, etc. In addition, the total reported petrochemicals production has some duplication of hydrocarbons because the total petrochemical production is based on sales, and where intermediate usage is involved considerable duplicate accounting occurs. These two factors are offset only slightly by losses in processing.

Raw material sources . . . I have estimated on the basis of figures available that the raw material required from petroleum is roughly 66⅔ per cent of the petrochemical production shown in Table 1. Refinery byproducts represent roughtly 60 per cent of the petrochemical raw material, the other 50 per cent being provided by natural gas and LPG derived from natural gas. In calculating the crude to petrochemicals shown in Table 2, I have taken these factors into account. The crude run to stills represent roughly 86 per cent of the domestic demand for petroleum. The table is significant, primarily because it shows the moderate increase in crude that will be required for petrochemicals as the requirement increases from 1.45 per cent of crude runs to stills this year to roughly 2.3 per cent of the estimated crude runs to stills in 1965.

TABLE 2—CRUDE TO PETROCHEMICALS

	Millions of barrels per year		Per cent crude to petrochemicals
	Total crude to stills	Crude to petrochemicals†	
1930	915	0.18	0.02
1955	2,590	35.5	1.35
1957*	2,940	42.6	1.45
1962*	3,690	72.0	1.95
1965*	4,270	98.8	2.30

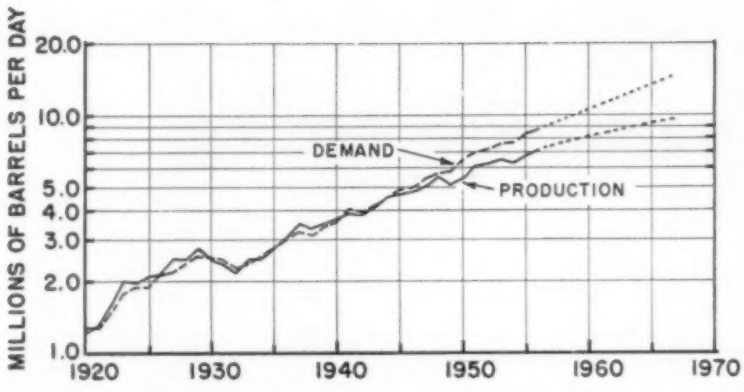
*Estimated. †Based on equivalent weight of 35°-API-gravity crude to weight of petrochemicals assuming refinery raw materials are 66⅔ per cent of petrochemicals production, and 50 per cent of petrochemicals are produced from refinery sources.

Although petrochemicals are estimated to increase more than 100 per cent, the crude run to stills is increased only 45 per cent. On the assumption that raw materials are produced in proportion to crude run to stills, the petrochemical industry by 1965 will require a 50 per cent bigger slice of the basic raw material than it is using today.

Petroleum Growth

"Will the petroleum industry support this increase in petrochemical growth?" The answer in my opinion to this question is yes.

Kenneth E. Hill, Harold D. Hammar, and John G. Winger, of Chase Manhattan Bank, have analyzed the demand and supply of petroleum in the United States and free world. The demand curve in million barrels per day for the United States is shown in Fig. 1. We see from Fig. 1 that



Source: The Chase Manhattan Bank "Future Growth of the World Petroleum Industry" U.S. Bureau of Mines.

DOMESTIC production and demand of crude oil. Fig. 1.

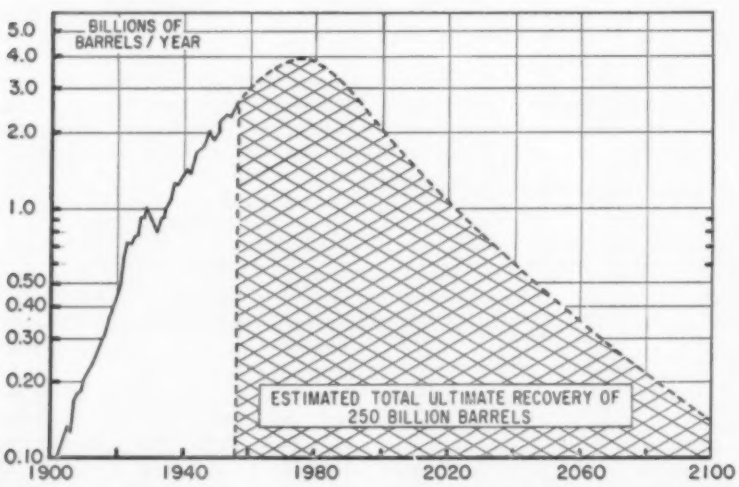
domestic demand is increasing somewhat faster than domestic production. Chase Manhattan estimated computed pattern of crude-oil production in the United States shown in Fig. 2 shows the production will increase through 1970.

Effect of Changing Technology

Changes in refining technology will be required to produce continually higher-octane gasolines. Although gasolines are not normally considered petrochemicals, it should be recognized that the production of the high-octane fuels required today and the higher-octane fuels of the future will result in the refining operation being a series of chemical processes or treatments. Thus, fuels will compete with petrochemicals for the building blocks required to meet the better antiknock quality of the future.

Increasing demand for middle distillates particularly for jet fuels, diesel fuels, and furnace oil will also require more processing and a greater degree of refining than has been carried out in the past. The trend in refining will be to increase the yields of middle distillates and to decrease residual fuel-oil yields through upgrading.

The trend in the accepted, recognized processing methods can be predicted and the resultant effect on petrochemical raw materials supplies indicated. These trends in future refining will affect raw-material supplies and costs, in some cases providing additional material for petrochemicals use. In other cases they will compete directly with petrochemical manufacturing for the raw materials. Table 3 shows the total domestic capacity for the well-established processes for the years 1952, 1954, and 1956 as given by The Oil and Gas Journal. This table shows the increase in crude-stilling capacity amounting to 10.8 per cent increase from 1954 to 1956. The effect of various processes employed in gasoline manufacture which will be changed to provide increased octanes in the future is shown in Table 4. Most of these processes will be found in a 1965 modern refinery. A look and consideration of each will be valuable.



Source: The Chase Manhattan Bank – "Future Growth of the World Petroleum Industry" U.S. Bureau of Mines.

COMPUTED PATTERN of crude-oil production in the United States. Fig. 2.

Thermal cracking is gradually decreasing in importance in refinery operation but it will continue to be used, particularly in the older refineries, for many years to come. The change in capacity here will not be great and will result in only a slight decrease in olefin production as a petrochemical raw material. Reduced thermal cracking will also mean decreasing supplies of heavier aromatic distillates and cycle fuel oils.

Catalytic cracking capacity is increasing at a greater rate than crude capacity. This process will continue to be a major factor in petroleum refining for gasoline manufacture. An increased conversion with a corresponding increase in light-hydrocarbon production is anticipated. Table 5 shows the effect on product distribution of increasing conversion. Under this condition there will be a substantial increase in yield of the light hydrocarbons, notably the olefins—ethylene, propylene, butylenes, and pentylenes. The trend in the byproducts from catalytic cracking, therefore, will be to increase substantially the quantities of unsaturates available. Competition for these materials will be very keen since many of them will be required in other refining operations as discussed below.

Catalytic reforming capacity increased 120 per cent between the two years 1954-1956 and further substantial increases are anticipated. Increases will employ the fixed-bed, platinum-type catalyst, and operation and processing will be at more severe conditions resulting in higher octanes. The effect of increasing octane on light-hydrocarbon production is shown in Table 6.

Catalytic reforming produces substantially no olefins but increasing process severity result in increased light saturated hydrocarbons.

One of the most important byproducts from catalytic reforming is the hydrogen produced and the hydrogen avails are also shown to increase roughly 15 per cent when increasing octane from 85 to 97. Most of this hydrogen is currently being employed in other refining operations although a substantial quantity is being employed in petrochemicals, particularly ammonia manufacture. The con-

TABLE 3—TOTAL DOMESTIC CAPACITY
(Thousands of barrels per stream day)

	1952	1954	1956	Percentage increase 1954-1956
Crude stilling	8,094	8,639	9,569	10.8
Thermal cracking	2,564	2,445	2,328	—4.8
Catalytic cracking	2,771	3,280	3,988	21.6
Catalytic reforming	297	569	1,245	120
Hydrotreating	....	117	796	580
Alkylation	....	227	273	20.3
Polymerization	102	127	144	13.4

Note: All rates based on charge capacity except alkylation and polymerization which are liquid product capacity.
Source: The Oil and Gas Journal's Annual Refinery Survey.

TABLE 4—EFFECT OF INCREASED OCTANES

Refining operations—	Predicted trend	Effect on petrochemical raw-materials supply
Thermal cracking	Slight decrease	Reduction in light-hydrocarbon unsaturates.
Catalytic cracking	Increased quantity	More light hydrocarbons due to increased conversion.
Catalytic reforming	Increased quantity	More light hydrocarbons due to increased conversion.
Extraction	Increased quantity	More normal paraffins—compete for aromatics.
Alkylation	Increased quantity	Compete for light hydrocarbons, particularly unsaturates.
Polymerization	No major change	Compete for light olefins.
Isomerization	Increased quantity	C_4 for alkylation, C_5 and C_6 for high octane.
Hydrogenation	Increased quantity	Compete for hydrogen—increase H_2S avails.

TABLE 5—REPRESENTATIVE CATALYTIC CRACKING

Conversion, per cent	50	70
Composition of product		
Hydrogen, wt. per cent	0.2	0.30
Methane, wt. per cent	0.7	2.60
Ethylene, wt. per cent	0.4	1.8
Ethane, wt. per cent	0.6	1.8
Propylene, wt. per cent	3.0	7.0
Propane, wt. per cent	1.4	3.0
Isobutane, vol. per cent	7.3	8.3
Normal Butane, vol. per cent	1.1	1.9
Butylenes, vol. per cent	5.1	10.4
Isopentane, vol. per cent	4.3	4.4
Normal pentane, vol. per cent	0.3	0.3
Pentylenes, vol. per cent	3.4	5.2
C_5-400° F., naphtha, vol. per cent	27.7	24.2
Gas oil, vol. per cent	48.3	30.3
Carbon, wt. per cent	4.7	8.5

centration of the hydrogen in the stream is in the range of 80 to 90 per cent and, in most refining operations, it is used as such without further purification.

Extraction by Udex, or by use of SO_2 is finding increasing utilization in the production of high-octane gasolines. Primary emphasis is on the concentration of aromatics and exclusion of normal paraffins. The normal paraffins removed will represent a problem to the refiner because he will have to process them severely in order to make high octane gasoline from them.

From the refiner's standpoint, these will be a byproduct and should be a good starting point for petrochemicals. These materials will not be given away since methods are available for upgrading them and thus making them acceptable motor gasoline blending stocks. But, because a relatively large investment will be required for a small quantity of fuel, the refiner may prefer other outlets for the normal paraffins.

Alkylation was originally installed to produce aviation gasoline. However, more and more alkylate is being added to the premium gasolines for motor fuel and additional alkylation capacity is being installed at a greater rate than crude-stilling capacity. The high-octane isoparaffin product from alkylation is a very desirable component in the premium gasoline today.

Most alkylation to date has been the C_4 alkylation employing butylenes and isobutane. A substantial quantity of pentylenes has been alkylated and some propylene alkylation is currently being carried out. In the future, there will be additional propylene and probably also ethylene alkylation employed to produce the quantity of high-octane alkylate required for premium gasolines.

Typical yields of alkylates by each of these processes are shown in Table 7.

The alkylation process is in direct competition with petrochemicals since it requires large quantities of olefins in the C_3 through C_5 boiling range and also requires large quantities of isobutane. In the past there has been and in the future there will be insufficient isobutane for alkylating all the olefins desired and undoubtedly the isomerization of normal butanes to isobutane will be practiced more extensively.

Polymerization is employed in refining to produce high-octane blending gasoline from propylenes and butylenes and additional capacity is being installed. This process is employed primarily as a balancing operation for these olefins when they are not required in other operations. A balance around the polymerization unit is shown in Table 8.

A substantial shrinkage in volume is experienced on polymerization but what is most important to the petrochemical industry is that since it provides a convenient process for making high-octane blending gasolines, it sets a minimum value for these olefins.

To compete for these materials, the petrochemical industry must offer a greater value than their use as charge

TABLE 6—CATALYTIC REFORMING

ASTM octane (research method)	85	97
Hydrogen, wt. per cent	*1.5	†1.7
Methane, wt. per cent	0.4	0.8
Ethane, wt. per cent	0.5	1.6
Propane, wt. per cent	1.3	4.2
Isobutane, vol. per cent	1.1	3.9
Normal butane, vol. per cent	1.5	5.0
Butane olefins, vol. per cent	0.2	0.3
Isopentane, vol. per cent	2.0	5.4
Normal pentane, vol. per cent	0.5	2.1
Pentane olefins, vol. per cent	0.1	0.1
Gasoline, vol. per cent	89.0	73.7

*Equivalent to 747 cu. ft. per bbl. feed.
†Equivalent to 853 cu. ft. per bbl. feed.

TABLE 7—ALKYLATION

(Hydrocarbons consumed per 1,000 bbl. of alkylate)

Ethylene alkylate:	
Ethylene	570
Isobutane	940
Propylene alkylate:	
Propylene	588
Isobutane	515
Butylene alkylate:	
Butylenes	610
Isobutane	480
Pentylene alkylate:	
Pentylenes	620
Isobutane	470

TABLE 8—POLYMERIZATION

	Charge to process (bbl.)	Product (bbl.)
Ethylene	0.1	.....
Ethane	1.2	.....
Propylene	29.6	.....
Propane	27.5	30.4
Butylene	18.9	.....
Butane and isobutane	22.7	24.6
Polymer gasoline	.....	32.4
Shrinkage in volume	.....	12.6
Total	100.0	100.0

The Oil and Gas Journal, May 27, 1957, page 177.

to polymerization. Developments in the field of polypropylene, polybutylene, and even polybutadiene may do just this for the petrochemical industry.

Isomerization is employed in refining of normal butanes, pentanes, and hexanes. As mentioned previously, butane isomerization has been used extensively in the preparation of isobutane for alkylation feed. This should increase in the future.

In addition, the normal C_5 and normal C_6 fractions will require isomerization to improve octane. Recently, numerous processes for the isomerization of normal pentane and normal hexane have been announced but commercialization of these processes is just beginning. This operation is going to increase in the near future as octanes increase.

Typical charge and yields from this operation are shown in Table 9. This process will not have much effect on

TABLE 9—PENTANE - HEXANE ISOMERIATION

	Charge to process (bbl.)	Product (bbl.)
Isopentane	17.5	49.4
Normal Pentane	34.6	2.6
2,2-dimethyl butane	0.4	4.4
2,3-dimethyl butane	1.4	3.5
2-methylpentane	11.7	13.6
3-methylpentane	8.4	9.5
Normal hexane	20.9	10.5
Cyclopentane	1.4	1.4
Methylcyclopentane	2.3	2.3
Benzene	0.4	0.1
Cyclohexane	1.0	1.3
Shrinkage	.....	1.4
Total	100.0	100.0

petrochemicals raw - materials avails. The yields shown represent a combined pentane-hexane fraction which is isomerized. However, in actual practice these fractions will very probably be processed separately. Also, it is probable that the normal paraffin will be concentrated and recycled to the isomerization operation to increase octane and yield.

Hydrogenation in refining operations is growing rapidly primarily because it can profitably utilize the hydrogen available as a byproduct from catalytic reforming. Refining operations employing hydrogen include: treatment of catalytic reformer feed stock; hydrotreating of middle distillates; desulfurization and finishing of lubricating oils and waxes. All of these processing operations are competing for the hydrogen available from catalytic reforming.

TABLE 10—HYDROGENATION

UNIFINING CALIFORNIA MIXED THERMAL AND CATALYTIC HEAVY NAPHTHAS

Mild Operation

	Charge	Product
Liquid yield, volume per cent of charge	.....	100
Gravity, °API	40.2	41.5
ASTM distillation, °F. initial	256	244
10 per cent	284	281
50 per cent	332	331
90 per cent	384	382
Maximum	414	410
Sulfur, weight per cent	0.52	0.09

100 bbl. of charge yield 140.9 lb. of H_2S.

UNIFINING CRACKED GASOLINES

Severe Operation

	Charge	Product
Liquid yield, volume per cent of charge	.....	100
Gravity, °API	46.1	51.1
ASTM distillation, °F. initial	221	196
10 per cent	257	249
50 per cent	313	310
90 per cent	390	385
Maximum	440	446
Sulfur, weight per cent	1.9	0.008

100 bbl. of charge yield 598.6 lb. of H_2S.

From a paper by Grote, H. W., Watkins, C. H., Poll, H. F., and Hendricks, G. W., presented at the annual meeting of WPRA in San Antonio, March 29-31, 1954. Published by The Oil and Gas Journal, April 19, 1954, page 211.

In practically all of these hydrogenation operations large quantities of sulfur are removed from the charge stock and appear as recoverable hydrogen sulfide in the recycle gas stream. As refining becomes more intensive and as hydrogenation in refining expands, more refiners will find it economical to recover hydrogen sulfide. In other cases, this method of disposal is mandatory as a method of air-pollution control.

The removal of sulfur from fuels is frequently required to meet sulfur specifications. Typical charge and refined-product tests and sulfur yields from treating gasolines are shown in Table 10 at both mild and severe operating conditions. The severe operation results in over four times as much sulfur as the mild operation. Utilization of hydrogen in refining operations is increasing rapidly and will undoubtedly exceed the hydrogen avails from catalytic reforming. This will necessitate the production of hydrogen and undoubtedly use will be made of the Texaco partial-oxidation process for making hydrogen.

Superfractionation equipment is being used by the petroleum industry in ever-increasing amount. Cosden, for instance, at Big Spring, Tex., is using three towers in series for ethylbenzene fractionation. This series of towers is said to be equivalent to 350 theoretical plates. Other refiners are resorting to superfractionation for both products and for selected charge stocks for units such as isomerization units. Superfractionation is no longer confined to the very light hydrocarbons. A source of potential petrochemical raw materials may well exist in streams being removed by giant superfractionators.

The Gulf Coast

The Gulf Coast—Texas and Louisiana—has been reported to produce 80 per cent of the petrochemicals. A major portion of these petrochemicals are produced from natural gas and LPG which are available in abundant quantities in this area. This has resulted in a substantial increase in the consumption of natural gas in Texas. The intrastate consumption of the natural gas produced in Texas has increased from 25.7 per cent in 1928 to 52.1 per cent in 1955. A major portion of this use of gas is as a fuel but increase in chemical production has also been an important factor in this growth.

Roughly 35 per cent of the domestic refining capacity is located in Texas and Louisiana. It is significant to note that in the years 1954-56 polymerization increased 13.4 per cent for total domestic capacity. In

contrast to this there was an 18.2 per cent reduction in polymerization capacity along the Gulf Coast. Undoubtedly, the increased demand of the petrochemical industry for raw materials was an important factor in this decrease of polymerization capacity along the Gulf Coast. Otherwise, the refinery trends along the Gulf Coast are similar and comparable to total domestic refining.

Natural Gas and LPG

Natural gas prices have kept moving up as consumption has increased. Consumption has increased in all usual fuel categories.

The use of natural gas for carbon-black manufacture has decreased due to a shift to the use of heavy fuel oil as a less-expensive raw material. Use of natural gas in the manufacture of ammonia has increased and is expected to continue to increase. However, total consumption of gas for chemical manufacture represents only a small fraction of the consumption of natural gas for fuel. No shortage of natural gas for chemical manufacture is anticipated.

However, the price of natural gas has increased from roughly 6 cents per M.c.f. in 1950 to over 10 cents or more today, and this trend is expected to continue in the future. As was the case with carbon black, cheaper sources of raw material will be sought by the petrochemicals industry.

LPG use has increased tremendously since the early 1930's. This increase is shown in Fig. 3. According to the U. S. Bureau of Mines, 1956 sales approached 7 billion gallons. About 30 per cent of this LPG was utilized in chemicals manufacture. The large increase in domestic consumption of LPG in the immediate post-war period has been a big factor in controlling the price of LPG and will probably continue to be a major factor in future price considerations.

It is anticipated that chemical utilization for LPG will continue its growth along with the other uses of LPG. The Gulf Coast is a major consumer of LPG for petrochemicals. Texas and Louisiana alone consumed 65.6 per cent of total LPG that went into chemicals and synthetic rubber in 1955.

There is a tendency towards the recovery of even lighter materials such as ethane, from natural gas and refining operations, and this trend is expected to continue and to increase the avails of LPG for chemical use. The production of natural-gas liquids, including natural gasoline, is expected to increase about 90 per cent in the next decade.

The growth of natural-gas production is not expected to be as great, showing an increase of roughly 50 per cent in the next decade. This should assure an adequate supply for petrochemical use. Of particular advantage for petrochemicals, would be gas sources which are not so located that they can be brought into the regular distribution systems and do not have an adequate supply to justify their own distribution system. Such a source of supply may provide an attractive source of natural gas for petrochemical manufacture.

Cost

So far, I have dealt primarily with avails and supplies of raw materials for the petrochemical industry. Cost is a major factor in these raw materials considerations and this is tied directly to the future prices of crude, natural gas, and LPG.

Today, crude prices are below replacement costs.

Exploration costs are increasing at a rapid rate. All factors point to rising costs of crude and natural gas including LPG. These rising costs are expected to be gradual and over a period of time, and it can be expected that they will be reflected in the price of raw materials and petrochemicals.

Shale Oil

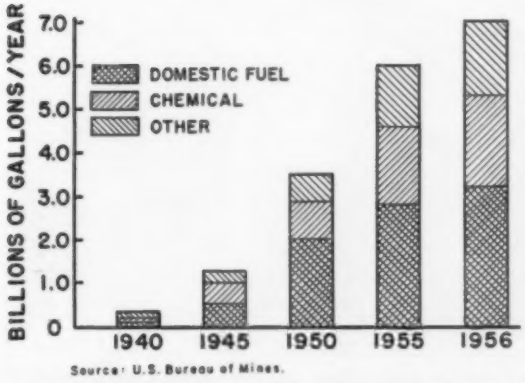
In the final analysis, the cost of petroleum will tend to stabilize at a value which will be close to that of the cost of producing a comparable fuel from shale oil. This is some distance in the future, but will become an increasing factor in the next decade.

In view of the increasing importance of shale oil, it is desirable to consider this also as a possible source of petrochemicals. It is probable also that the first shale-oil production may be justified primarily on the basis of chemical production with fuel as a by-product since the chemicals have been one of the economic mainstays of the Swedish oil-shale operations.

As a very rough generalization, it is probable that the chemical raw materials from shale oil will be similar to those from petroleum. The quantities of various raw materials available will depend on the retorting operation and the subsequent refining operations which may differ somewhat from those currently used in petroleum refining. Chemicals will be produced from shale oil in the future. An industry will not be established by 1965 but undoubtedly a great deal of experimental work will be done and the advent of shale-oil-derived chemicals may be around the 1965 era.

Foreign Developments

The world situation is changing and will have a marked effect on the demand for domestically manufactured petrochemicals. Foreign areas are developing their own petrochemical industries, in many instances sponsored by venture capital from the United States. Recognition of this by the petroleum industry may have an effect on future planning for internal use of refinery streams. This will mean that export markets will not grow as fast as they have, and in fact, in some areas may cease to grow altogether or even shrink.



CONSUMPTION of liquefied petroleum gas. Fig. 3.

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Aqueous-amine acid-removal process needn't be corrosive

Here's how to design to minimize corrosion

BY J. S. CONNORS

THE AQUEOUS-AMINE process for removing acid from natural gas—long an industry headache because of corrosion—can be made practical with proper design of an amine treater.

Previously, expensive alloys were substituted for the original carbon-steel equipment. Now, with correct designing, corrosion can be minimized and the use of all carbon-steel equipment permitted.

1—WHY CORROSION?

In the design of amine treaters, it should always be assumed that the solution will be corrosive to some extent. Amines oxidize readily and the oxidation products are extremely corrosive. The primary product of amine oxidation is formic acid.[1] The formic acid, immediately after formation, reacts with additional amine to form a formamide. Such formamides attack carbon steel rapidly. Also, amines are not stable at high temperatures[2 3 4] and the decomposition products are corrosive.

These two characteristics of the amines used for gas treating make it imperative that every precaution be used in both plant design and operation to: (1) prevent the solutions from coming into contact with air; (2) prevent excessive temperature; (3) provide equipment for removal of any corrosive compounds which may be formed; and (4) design the plant mechanically to withstand a somewhat corrosive solution at all times.

Chemical reaction - physical absorption . . . In addition to the above requirements, it should be remembered that at high pressure amine solution will remove acid gases by means of both chemical reactions and physical absorption. If the acid gas contained in the foul solution is more than the quantity needed to form amine carbonate, both amine carbamate and free carbon dioxide will also be present. Such a condition will lower the pH of the solution, accelerating the rate of corrosion.

The affinity of the alkanolamines for acid gases is actually a reversible chemical reaction in which the chemical bonds are so loosely attached that the process behavior is similar to that of physical absorption. It is believed that this reaction can be expressed by the following equations:

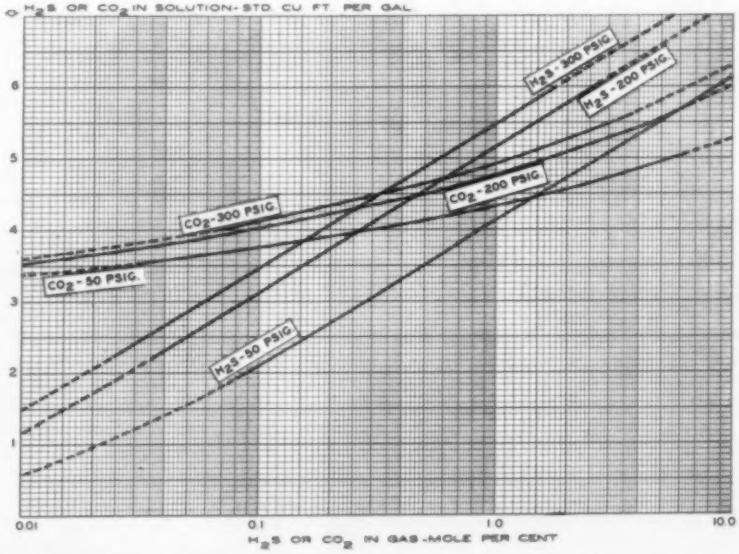
$$2\,RNH_2 + H_2S \underset{240^\circ\,F.}{\overset{100^\circ\,F.}{\rightleftarrows}} (RNH_2)_2 \cdot H_2S$$

$$2\,RNH_2 + CO_2 + H_2O \underset{300^\circ\,F.}{\overset{120^\circ\,F.}{\rightleftarrows}} (RNH_2)_2 \cdot H_2CO_3$$

or

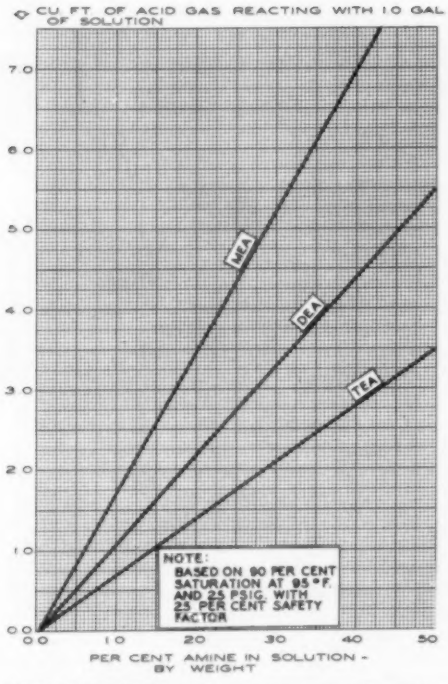
$$2\,RNH_2 + H_2S \underset{240^\circ\,F.}{\overset{100^\circ\,F.}{\rightleftarrows}} (RNH_3)_2S$$

$$2\,RNH_2 + CO_2 + H_2O \underset{300^\circ\,F.}{\overset{120^\circ\,F.}{\rightleftarrows}} (RNH_3)_2 \cdot CO_3$$



EQUILIBRIUM of hydrogen sulfide and carbon dioxide over 15 per cent MEA solution at 100° F., recalculated from Girdler data. Fig. 1.

Author is with Phillips Petroleum Co. at Bartlesville, Okla. Paper was presented at University of Oklahoma gas conditioning conference.



ACID GAS PICKUP with varying strength amine solutions. Fig. 2.

Equations 1 and 2 represent the views of R. R. Bottoms and Equations 3 and 4 represent the views of R. M. Reed and N. C. Updegraff of the Girdler Corp.

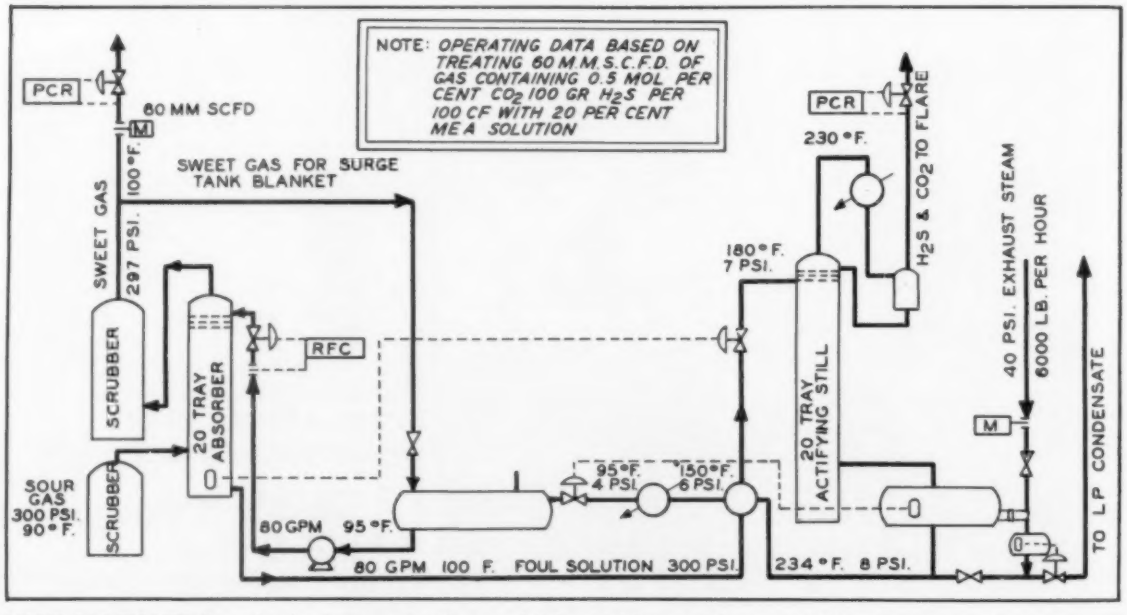
Contact temperatures . . . In the above equations, RNH_2 is monoethanolamine (MEA). A similar set of equations can be set up for both diethanolamine (DEA) and triethanolamine (TEA). These equations show that it requires two moles of MEA to react with one mole of either carbon dioxide (CO_2) or hydrogen sulfide (H_2S).

The revision temperatures shown are only approximate. However, the reverse reaction is initiated between H_2S and the amine at a much lower temperature than is the case for CO_2. Therefore, contact temperature for H_2S removal should be 100° F. or lower. Similarly, for the removal of carbon dioxide contact temperatures can be in excess of 150° F. Also, as can be expected from the reaction, the disassociation temperature for the carbon dioxide amine complex is considerably higher than for the hydrogen sulfide complex. Therefore, while it is possible to obtain virtually complete stripping of hydrogen sulfide from amine solutions at 240° F., approximately 0.5 to 1.0 cu. ft. of carbon dioxide per gallon will remain in the stripped solution; while at temperatures of 300° F., nearly all of the carbon dioxide can be stripped from the solution.[5]

MEA concentration . . . Because the reaction is chemical in nature rather than physical, increasing the strength of the solutions will increase their capabilities to remove acid gases. However, such increases must be evaluated with care, since stronger solutions will not regenerate so completely and the consumption of amines will be higher. For plants using 15 to 20 per cent solutions of MEA and treating average sour gases, the consumption of MEA will vary from approximately 0.6 lb. per M.M.s.c.f. of gas processed to approximately 1.5 lb. per M.M.s.c.f. of gas processed as the contact pressure varies from 200 to 50 psig.

Solution loading . . . Equilibrium of hydrogen sulfide and carbon dioxide over 15 per cent MEA solutions for three pressures is shown in Fig. 1. However, since the process is based upon chemical equilibrium rather than physical equilibrium, the total loading of the foul solution should never exceed the reacting value of the amines for H_2S and CO_2 as shown by the preceding equations.

Fig. 2 shows the allowable pickup of acid gas, based upon reacting values with an allowance for acid gas left in the solution after regeneration, assuming low-pressure regeneration conditions. These curves apparently hold good over a wide range of pressures and acid-gas contents as shown by the data in Table 1. This data was obtained from commercial operating units. The solution loading was obtained by reducing the solution circulation until the treated effluent gas



AMINE GAS TREATER flow sketch, showing equilibrium of H_2S and CO_2 over 15 per cent MEA solutions for three pressures. Fig. 3.

TABLE 1—ACID-GAS PICKUP BY AQUEOUS MEA SOLUTIONS

Pressure of absorbers, psig.	50	50	200	200	200
Per cent MEA solution	14.97	19.12	20.1	18.2	19.6
H_2S in gas to absorbers, grains per 100 cu. ft.	399	472	8.0	72.5	92.4
CO_2 in gas to absorbers, mole per cent	4.967	4.451	0.105	0.6	0.63
H_2S in treated gas, grains per 100 cu. ft.	1.415	2.17	0.1	0.1	0.07
CO_2 in treated gas, mole per cent	0.555	0.61	0.03	0.062	0.03
Total acid gas in foul solution, cu. ft. per gal.	3.954	5.077	4.5	4.07	4.40
Total acid gas in lean solution, cu. ft. per gal.	0.782	1.333	1.2	0.58	1.39
Acid-gas pickup by solution balance, cu. ft. per gal.	3.172	3.744	3.3	3.49	3.01
Acid-gas pickup by gas balance, cu. ft. per gal.	3.59	3.31	3.53	3.35	3.79

contained the maximum H_2S content permissible with operating requirements.

2—PROCESS DESCRIPTION

In the operation of this type of amine-gas purifier, the operating cycle and the equipment required are very similar to those of the absorption and the stripping processes of a natural-gasoline plant. A typical flow sketch of the process is shown in Fig. 3.

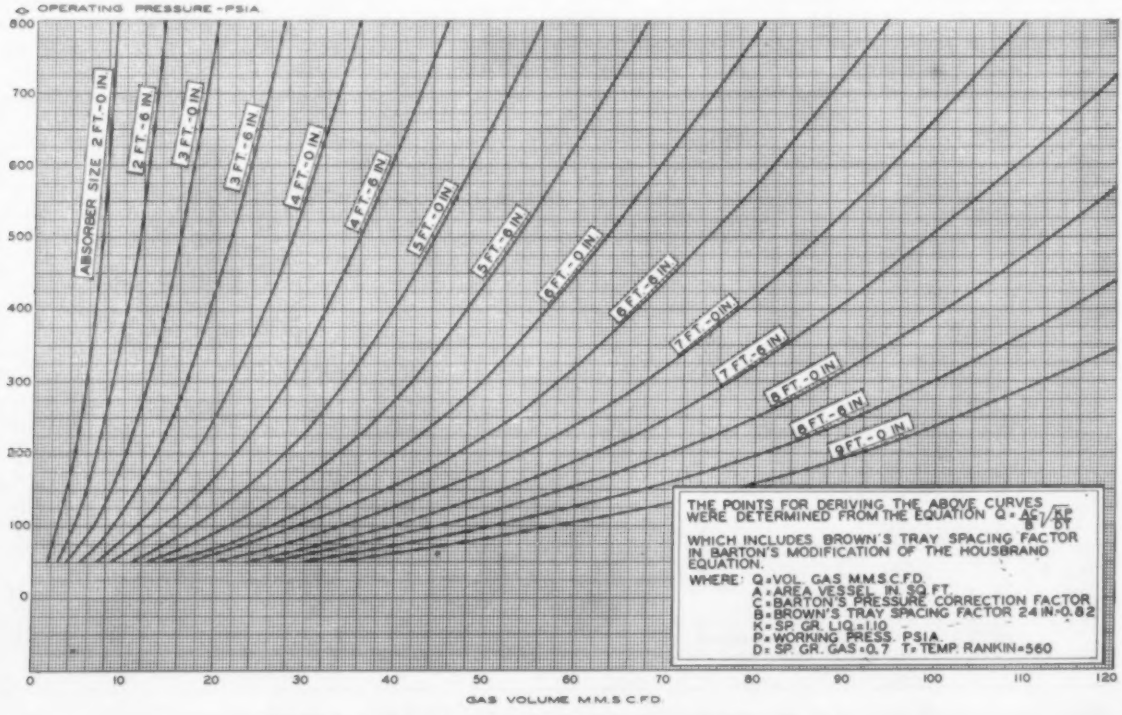
Contacting . . . The gas to be treated flow upward through a bubble tower or packed column contactor, and aqueous-amine solution at atmospheric temperature (80°-100°F) enters the top of the tower and flows downward, picking up the acid gas. Purified gas leaves the tower at the top. The foul amine solution, saturated with acid gas, leaves the bottom of the tower and passes through heat exchangers in which the temperature is raised to 180°-200° F and into the top tray of the stripper or reactifying still.

Stripping . . . The stripper contains in its base or in an external kettle a tubular heating element or reboiler. At the top of the stripper are condensers and a dephlegmator or water separator. The amine solution flowing downward through the stripper to the reboiler section is heated to approximately 230°-240° F. by vapor rising up from the boiling solution in the reboiler section.

The acid gas liberated from the amine solution and a portion of the internally generated stripping steam are carried overhead from the top of the stripper through the condensers, where the steam is condensed and cooled. The condensed steam and acid gases are separated in the dephlegmator. The condensate is returned to the top of the stripper as cold reflux; and the acid gases are burned in a flare or sent to a processing unit.

Hot lean solution stripped of acid gas flows from the stripper kettle to the heat exchangers, where heat is exchanged in heating up the cold foul solution and then through water coolers, where it is cooled to approximately atmospheric temperature. From the water coolers, the cold lean solution goes to a surge tank, from which it is pumped to the contactor, thereby completing the cycle.

Control valve location . . . In this type of treater, it is important that the motor valves controlling the solution flow from the contactor to the stripper and from the stripper to the surge tank be located in the position shown in Fig. 3. Locating the motor valves



CURVES for estimating absorber size in gas treating. Fig. 4.

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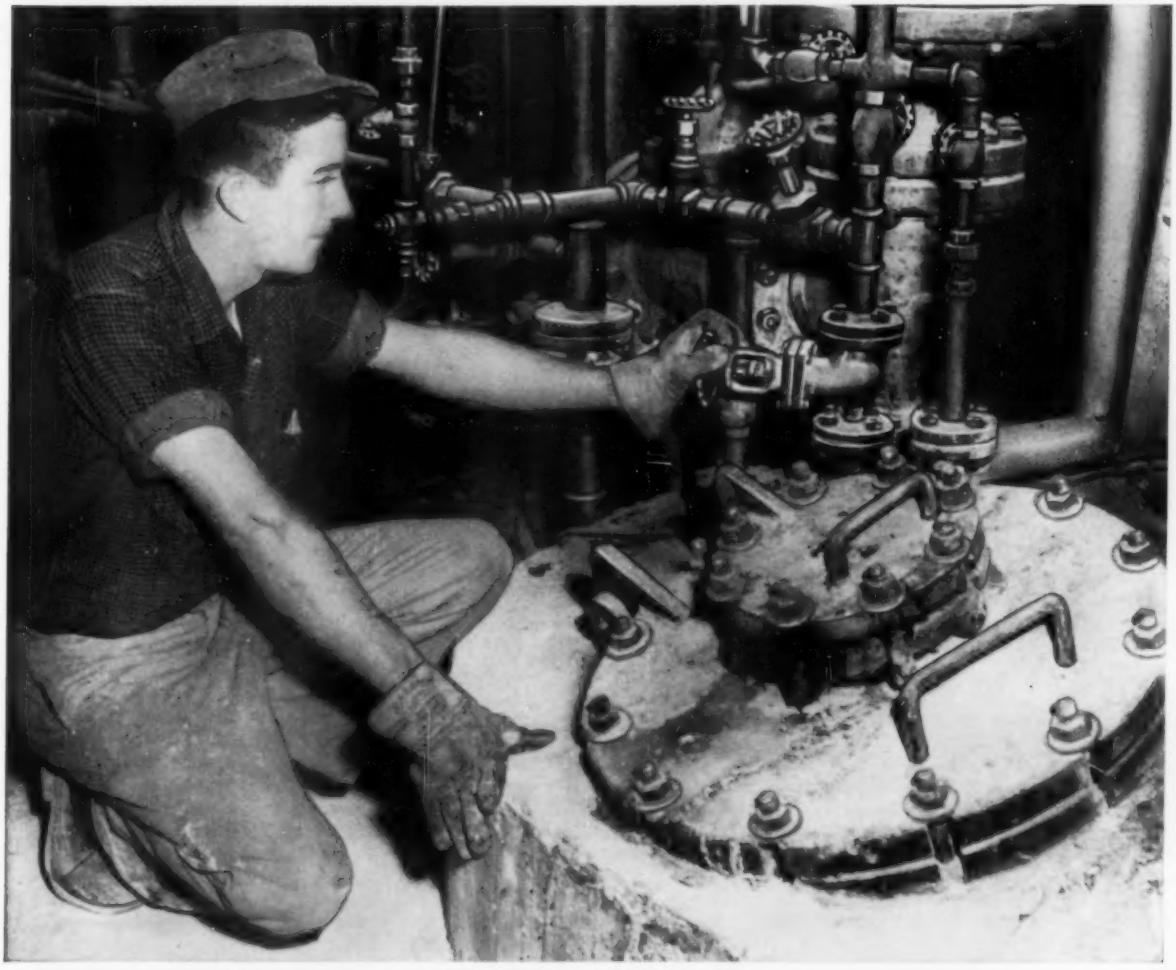

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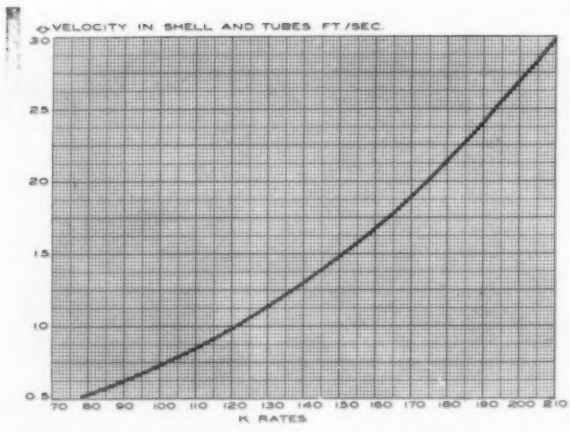
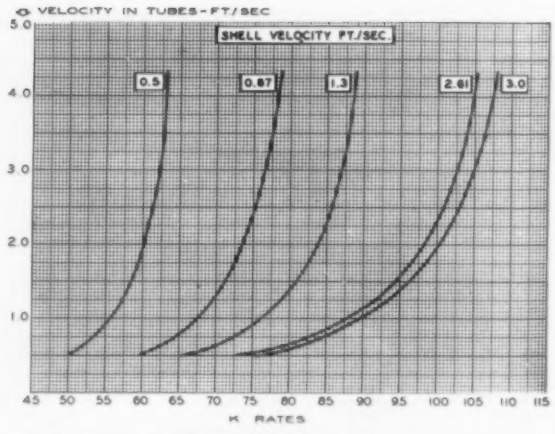


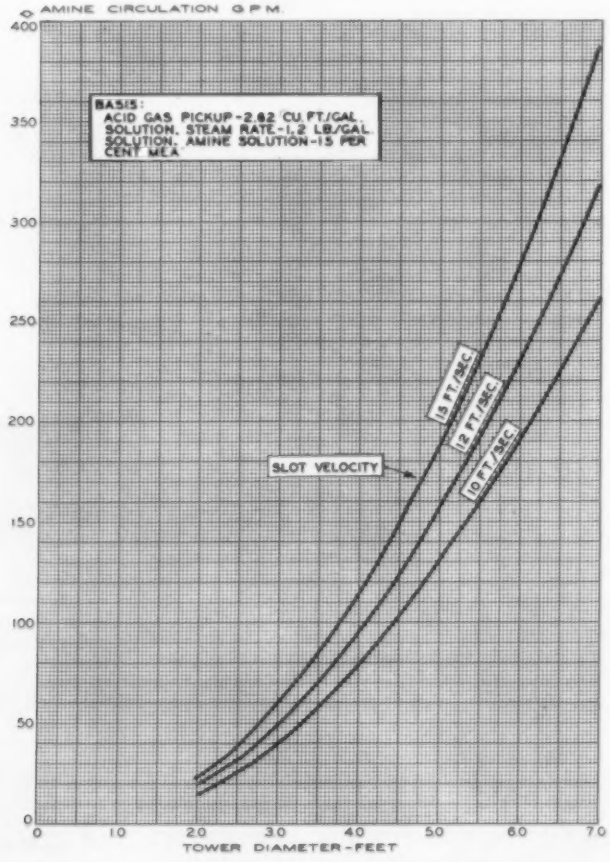
AMINE HEAT EXCHANGERS, fouling factor of 2. Fig. 5.



AMINE SOLUTION COOLERS, fouling factor of 6. Fig. 6.

upstream of the heat exchangers will cause severe corrosion of heat exchange equipment downstream of the motor valves. It is believed that the excessive rates of corrosion in cases are due to flashed acid gases liberated from the solution by pressure reduction through the motor valves.

Because of the fairly rapid rate of reaction in the stripper, virtually complete stripping of H_2S from the solution can be accomplished in a single tower, using a steam rate of approximately 1.2 lb. of steam per gallon of solution (exhaust steam at 40 psig). Since aqueous amines have very little affinity for the hydrocarbon constituents of the gas to be purified, this process is applicable to the purification of field gases prior to gasoline extraction as well as to residue gas.[1,2]



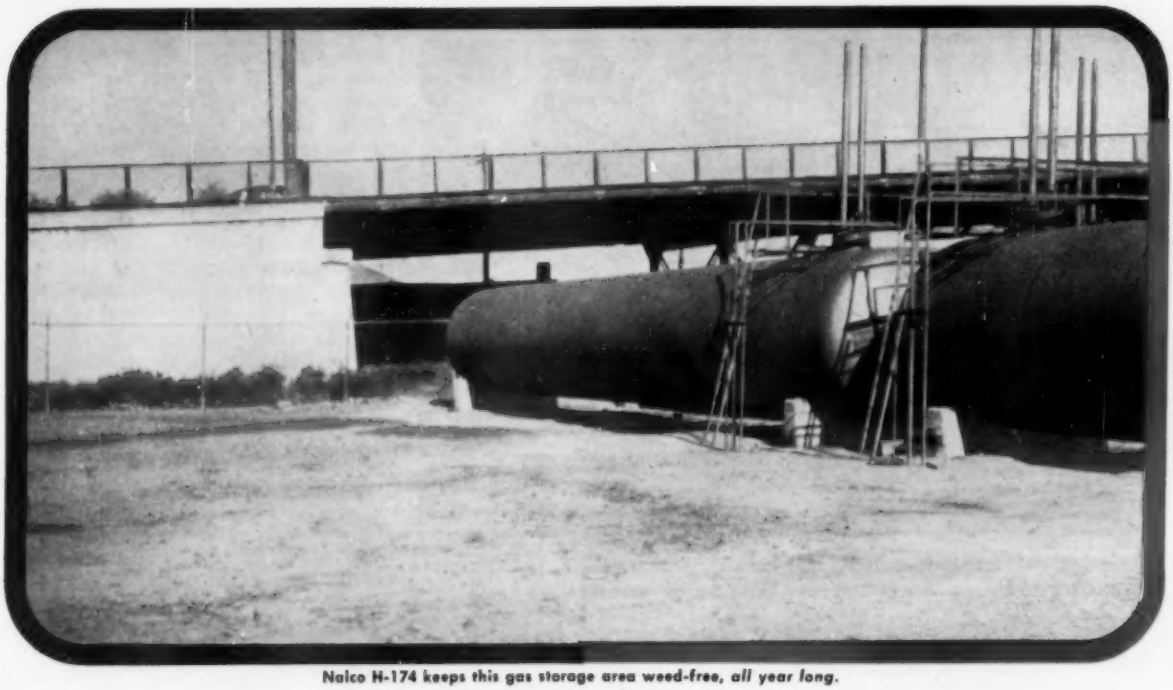
CURVES for estimating reactifier size for amine gas treater; pressure—7 psig.; and bubble-cap slot area—12.2 sq. in. Fig. 7.

3—OPERATION AND DESIGN

While the aqueous-amine solution used in purifying gases containing hydrogen sulfide and carbon dioxide are generally considered to be only mildly corrosive to carbon steel, the susceptibility of amines at elevated temperatures to decomposition[2,3,4] and its tendency for the formation of formamides when in the presence of oxygen[1] make it mandatory that extreme care be used in the plant design and operation. The surge tank must be blanketed with gas at all times. In addition, amine solutions have a tendency to foam, especially when wet field gas is being purified. Taking these properties into consideration, the following information is presented as a general guide for the operator and designer.

How many plates? . . . In the design of the contactors, chemical-equilibrium curves are not always reliable. Experience has shown that where only three or four theoretical stages of contact are calculated to be required the actual number of bubble plates required may be 16 to 20. This is apparently due to the difficulty in securing adequate contact when removing the last traces of hydrogen sulfide, and due to the fact that the element of reaction time is always a factor. The contactor should always be stress-relieved to minimize the ever present danger of stress corrosion cracking occuring.[6]

Vessel sizing . . . The following formula[5] has been found to give excellent results for vessel sizing, subject to some consideration of maximum slot



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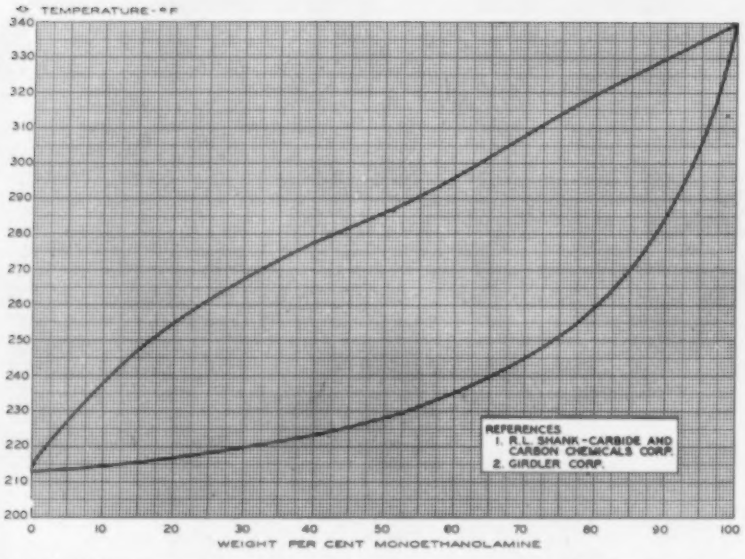


VAPOR-LIQUID composition boiling point curve for aqueous MEA solutions. Fig. 8.

velocity and down-comer requirements:

A = BQ/C (DT/KP)$^{1/2}$
A = Tower cross-sectional area in sq. ft.
B = Brown bubble-plate tray-spacing factor, see Table 2.
C = Barton bubble-plate absorber-pressure correction factor, see Table 3.
D = Specific gravity of gas, referred to air (29D = mole wt. of gas).
K = Specific gravity of liquid at T°, referred to water at 60° F.
P = Gas pressure in psia.
Q = Gas volume, M.M.s.c.f. per day.
T = Temperature, °R. (°F.+460).
S.c.f. = Standard cubic feet measured at 60° F. and 14.7 psia. pressure.

Fig. 4 shows a chart for estimating the size of towers of varying volumes or pressures as determined on the basis of the above formula.[1]

TABLE 2—BROWN TRAY-SPACING FACTORS

Tray spacing (in.)	Tray-spacing factor, B
18	1.00
24	0.82
30	0.75

TABLE 3—BARTON PRESSURE-CORRECTION FACTORS

Pressure range (psig.)	Pressure-correction factor, C
0-25	0.78
25-50	1.12
50-100	1.35
100-400	1.56

Heat exchangers . . . Carbon-steel exchangers are generally satisfactory as long as the solution has no aggravated tendency toward corrosion and if linear velocities do not exceed 2-3 ft. per second. Since nearly all amine solutions contain some suspended particles of iron sulfide, it is the author's recommendation that a velocity of 2 ft. per second be considered as the optimum. Fig. 5 shows the effect of linear velocity on the over-all "U" rate, assuming that the exchanger is designed so that shell and tube velocities are equal.[1] Fig. 6 shows the variation in over-all "U" rates for solution coolers with varying velocities on the shell and tube side.[1]

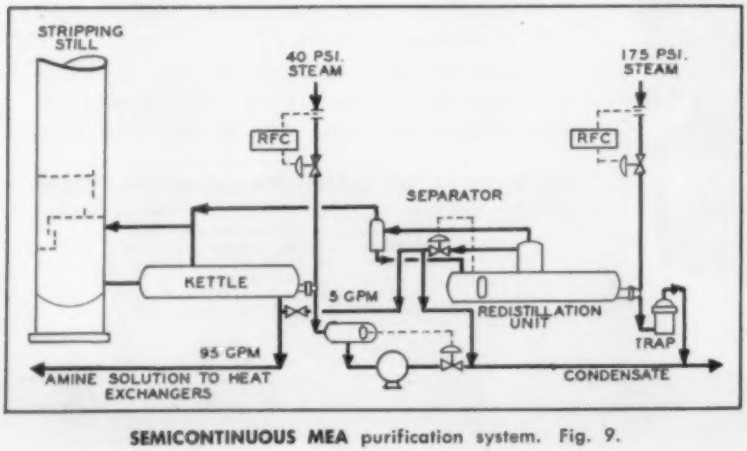
Reboiler temperature . . . Since it is considered by some operators that amines decompose at elevated temperatures,[4] it is the author's opinion that 250° F. should be the maximum allowable kettle temperature, and that only steam at a temperature not exceeding 300° F. be used as the kettle heating medium.

The tube spacing in the reboiler elements should be arranged so as to provide adequate vapor-relieving capacity to prevent vapor binding and local overheating. For elements up to 30-in. i.d. containing ¾-in. o.d. tubes on triangular setting, a 1¼-in. center-to-center spacing is recommended. Also, two rows of tubes forming an X should be left out of the bundle to permit entry of solution into the center of the bundle. For larger diameter elements, additional rows of tubes should also be omitted.

Stress-relieve . . . The stripper and the external kettle shell (where used) should always be stress relieved to minimize the danger of stress corrosion cracking.[6] As in the case of the contactor, it is difficult to calculate the theoretical number of trays required and to correlate tray efficiencies, contact and reaction time to arrive at the number of actual bubble trays required. For these reasons, most strippers contain approximately 20 bubble trays.

Stripping-still sizing . . . Fig. 7 shows a chart of stripping still sizes which have been found to be adequate.[1] The Brown-Souders formula was used in computing the over-all tower cross-sectional area required with modification for slot velocity.

If MEA solutions have become corrosive, either from oxidation or high temperature, they can be purified by simple distillation, using a semicontinuous process as indicated by the vapor-liquid composition diagram shown in Fig. 8. A sketch of a redistillation process where the amine feed is a side stream from the operating



SEMICONTINUOUS MEA purification system. Fig. 9.

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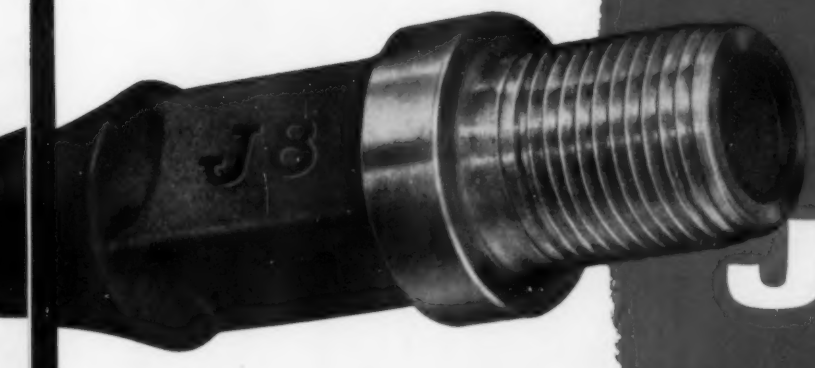

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J-7	Protector ends painted ORANGE	For medium to heavy pumping loads under all conditions	Called "standard of the industry". Strong, corrosion resistant nickle molybdenum steel, fully normalized, tempered, descaled and shot peened for further fatigue and corrosion resistance.	65-80	85-100	14-22	60-70	90-107	170-210
J-2	Protector ends painted WHITE	For medium to heavy pumping loads in non-corrosive fluids	High grade carbon manganese steel, fully normalized, descaled and shot peened to add strength and endurance.	60-75	90-105	18-24	60-70	80-90	160-210

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still with gravity feeding is shown in Fig. 9. The tendency of the solution to corrode can be estimated from the iron capacity of the solution under set conditions of test.[7 8] These tests are qualitative and a better quantitative test is a measure of the rate of buildup of nitrogen compounds other than MEA in the system as determined by Kjeldahl and Van Slyke procedures.

It is realized that if the information presented is used in the design of a gas purification plant, the investment required may be increased. However; Feagen, Lawler, and Rahmes have outlined the justification for such increases, in their paper.[9]

Acknowledgement

At this time, I wish to express my appreciation to American Gas Association and to R. V. Warrick, assistant editor of Gas Engineer's Handbook, for permission to use material which has been offered for the Handbook.

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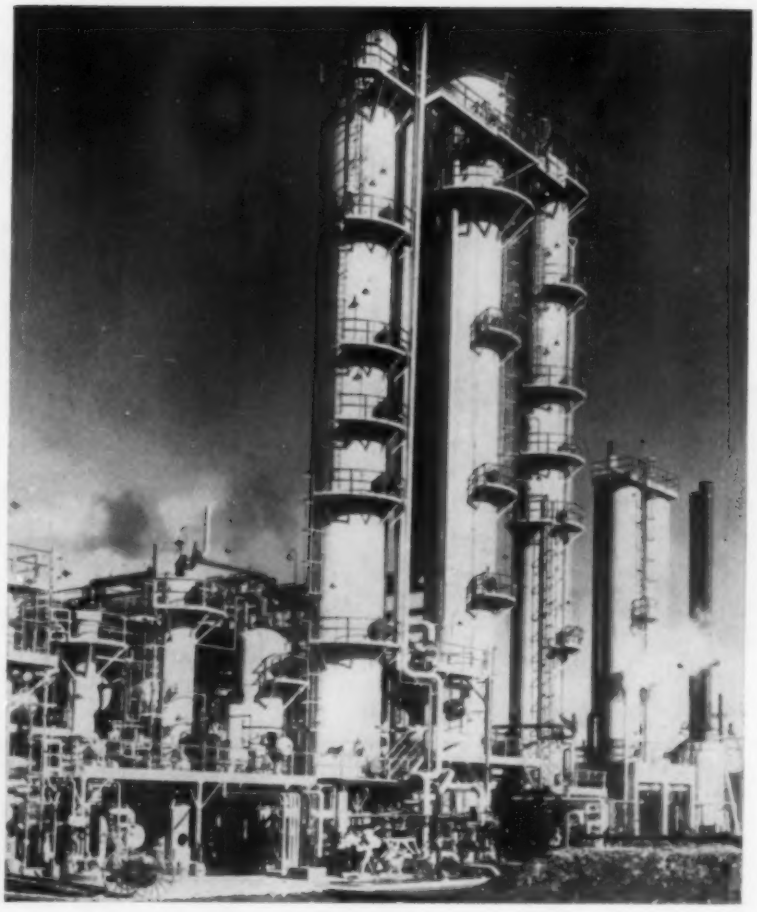

Petrochemicals manufacture destined for a boost so . . .

Humble completes benzene plant

ANOTHER BIG step in Humble Oil & Refining Co.'s program of expansion in the petrochemicals field was completed recently as a new benzene plant started up at its Baytown refinery.

Designed to produce about 30 million gallons of high-purity benzene a year, the plant is one of the largest of its kind in the world.

Construction on the unit began in April 1957. It is the first petrochemical plant built at the refinery in several years. The last unit, which produces paraxylene, the base stock for synthetic fibers, was completed in 1953. Since then, Humble has been producing new chemical products by altering and adding to existing units.

The new plant is also the first unit to be built on a 40-acre tract of land in the northwest section of the refinery that has been set aside as a specialty products area. Humble has not announced what additional petrochemical units will be built in that area and an adjacent 40-acre tract also set aside for petrochemical expansion, but others are planned.

The new facilities are integrated with other refinery operation, and the feed stock for the unit will come from a nearby hydroformer.

The output from the plant will be sold in the Gulf Coast area, where there is a large and growing demand for this basic chemical raw material. It will be transported by barge, railroad tank car and tank truck.

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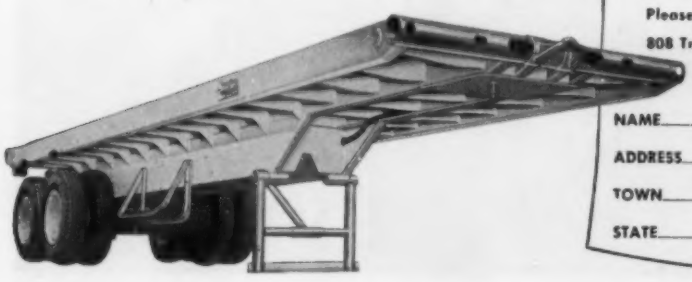

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Chemical compatibility problems in water-injection systems

The authors say . . .

The nature of the water-injection problem is highly complex and varied. It may be very specific in the individual case. Recognition and thorough analysis are the first steps toward preventing or overcoming the difficulties.

Various treating techniques and commercial products, developed especially to cope with injection problems, now have had sufficiently extended field use to establish their merit.

Wider applications of these, with careful attention to their over-all suitability in the system, appear justified. Continuing research will clarify the areas of uncertainty which now exist and lead to improvements in the techniques and economics of water injection.

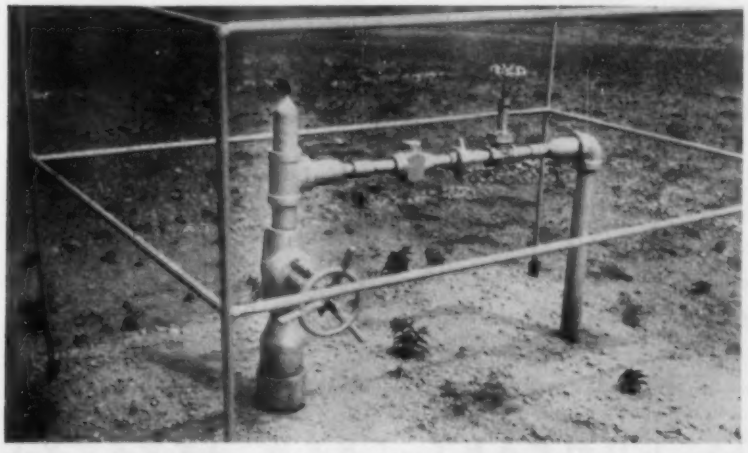
BY G. J. SAMUELSON and B. H. MOORE
Petrolite Corp.

IN PETROLEUM PRODUCTION, water may be injected into subsurface strata for either of two major purposes: (1) to stimulate production, as in secondary recovery; or (2) to dispose of the water (brine) where so much is produced with the oil that it cannot, because of salt or other contamination, be disposed of by surface drainage.

In each of these injection situations certain problems exist. The underground formations may act as extremely effective filters, and thus the waters must be free of suspended or dissolved matter which might block the fluids by deposition of solids, either existing in the fluids or produced by chemical reaction with the formations.

Various chemicals and processes may be used in pretreating such injection waters to improve injectability. These are designed to remove existing or potential causes of formation plugging. Simple sedimentation, with or without chemical flocculating agents, followed perhaps by filtration, removes suspended matter.

Bactericides or algaecides may be required to control sulfate-reducing or other bacteria and algae. Inhibitors may be used to prevent the formation of corrosion products. Surface-tension reducers may be added to overcome the normally high resistance of the formation interstices to passage of water. Chemicals with dispersant or sequestering characteristics may minimize scale deposition.



WATER-INJECTION WELL such as this is used in many instances in water-flood projects.

When additives are used—especially if different ones are to be used simultaneously or successively in the same injection system—these must be compatible with each other and with the subject water. Indeed, where the injection water is compounded, perhaps of produced brine and fresh surface water, the compatibility of these waters themselves must be considered.

Source Waters

Whatever the water source (surface or subsurface) the water ideally should be entirely free of suspended matter—a true solution—at the point of injection. Success in injection, other factors being equal, is directly related to the approach to this ideal, which is not easily attainable in commercial practice.

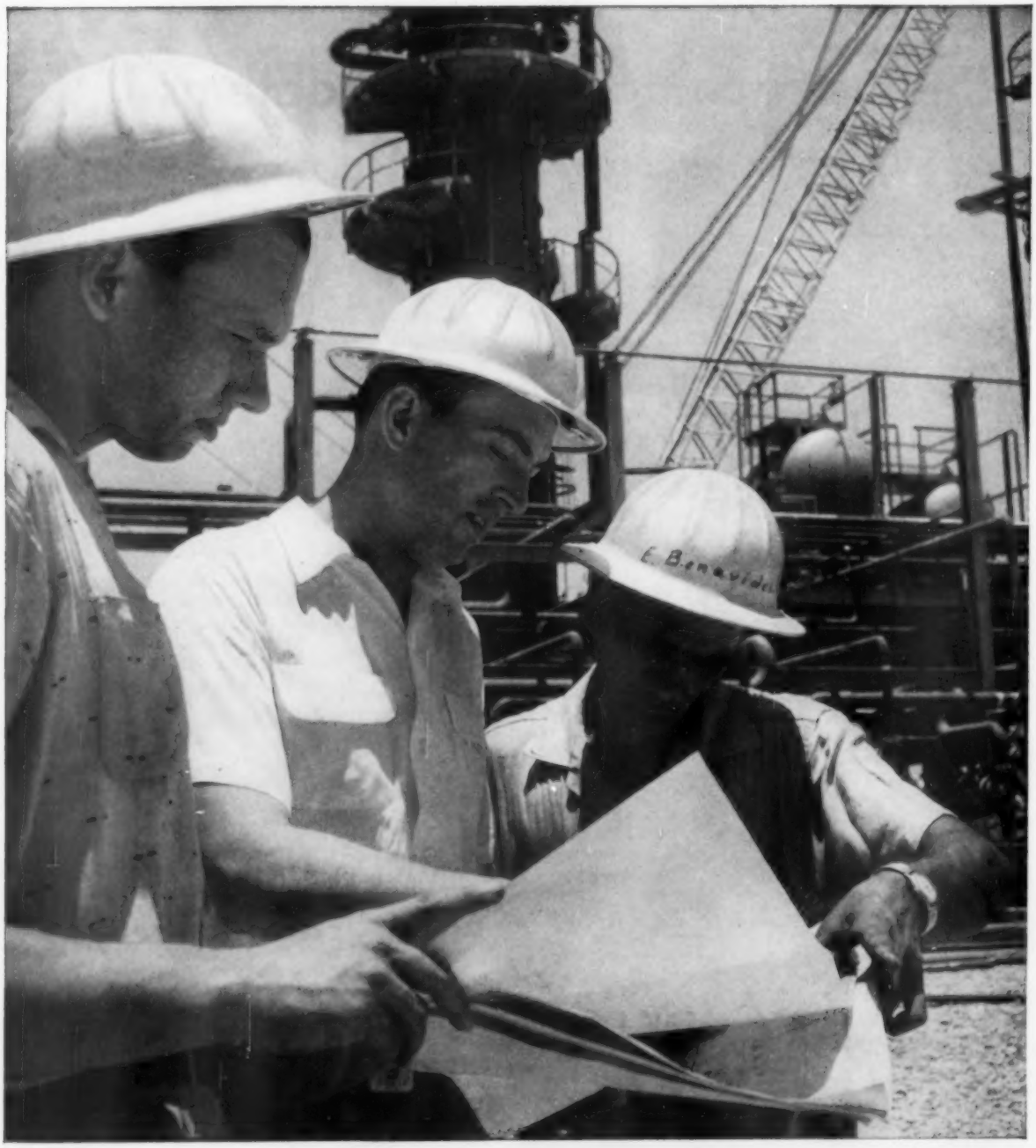
Waters apparently free of suspended solids may actually contain some solids. Since large volumes of water must be forced through comparatively small areas of subsurface formation faces, these solids can quickly plug the injection wells.

A subsurface water carrying solids and perhaps gases in true solution at formation temperature, pressure, and pH may, at surface conditions, exhibit incipient and hardly detectable precipitation of carbonates and sulfates which can cause scaling and plugging.

Similar problems may arise when otherwise satisfactory source waters are mixed. For example, when those containing calcium, barium, or magnesium ions in true solution encounter others containing dissolved sulfates or carbonates, trouble arises. A similar situation occurs when ferrous ion-containing water is mixed with that containing sulfide ion.

Such problems of compatibility can normally be dealt with by standard treating methods, provided they are in the hands of competent engineers who recognize their nature. More difficult are the potential problems of chemical or physical reaction of the clean waters with the injection formation.

Chemical reactions of ions in the



"An investment is good only if it is mutually beneficial to the investor and the people of the host country. When the proper climate exists for capital investment, many benefits come to countries where investments are made. While the investor expects a return on the investment, the additional capital generated is plowed back into the host country to underwrite the continuation of industrial development."

Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

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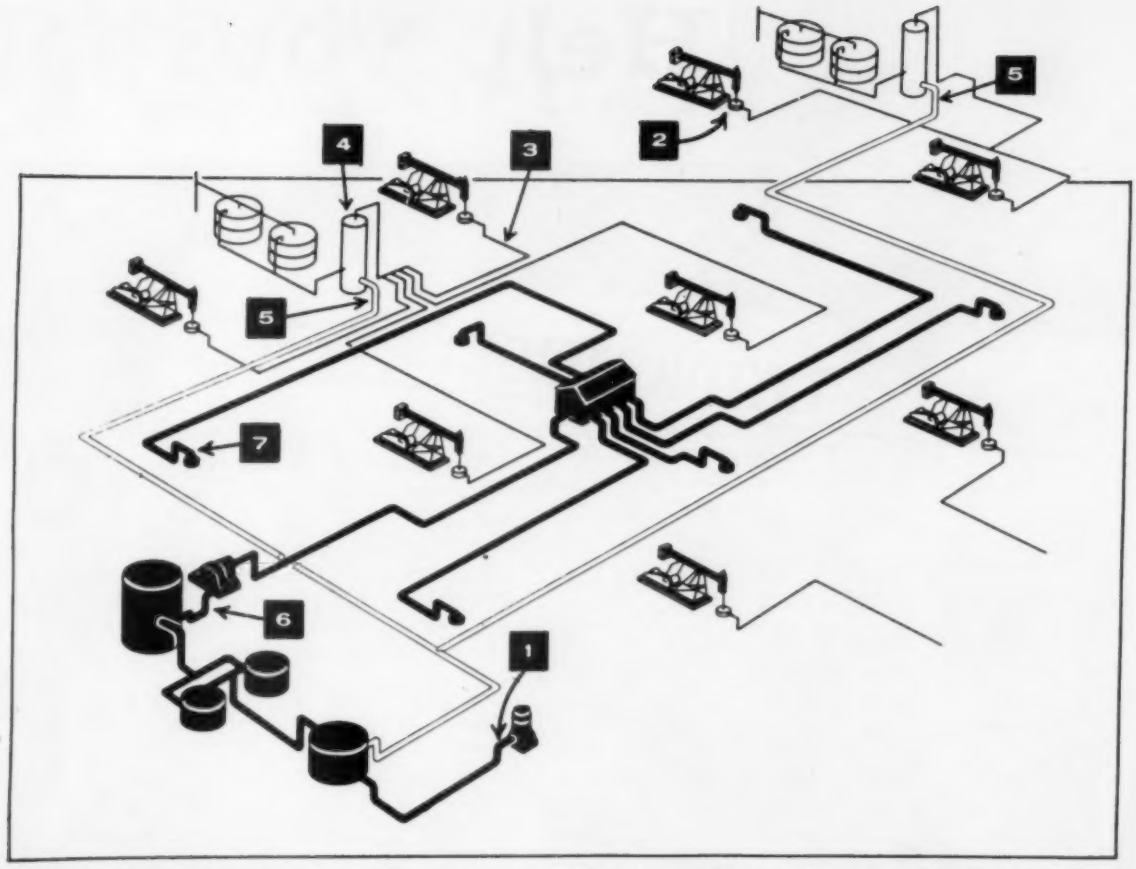

CHEMICAL INJECTION POINTS in water-flood and disposal systems: (1) supply water systems; (2) producing wells; (3) lead lines; (4) gun barrels, heater treaters; (5) produce water gathering systems; (6) water injection systems; (7) water-injection wells.

waters with formation components to precipitate insoluble salts on or within the injection face may decrease injectability. Swelling of bentonitic structures on exposure to certain types of waters can be disastrous.

In addition to these problems, there is that of corrosion products resulting from contact of the waters with the piping system, both ahead of and after the injection wellhead. If oxygen is present in the system, corrosion products may quickly lower injection efficiency. Associated with corrosion in some of its aspects is also the problem of bacteria, which themselves may present plugging problems.

Chemical additives, when properly applied, may minimize these injection difficulties.

Chemical Treatment

To remove organic and other suspended matter, sedimentation with or without aluminum or iron salts (alum) treatment is customary before filtration. These are well-known steps in water-purification procedures and will not be elaborated upon.

It should be recognized, however, that while these remove impurities, the use of alum also contributes ions ($SO_4^{=}$ and others). The compatibility of these added ions with other components, later added or present in the formation, should not be ignored. The control of pH often required in alum flocculation may have a profound influence—beneficial or adverse—on scaling and corrosion.

Biocides . . . An oxidizing biocide such as chlorine is commonly used as an economical means of destroying or controlling aerobic bacterial and algae growth, especially prevalent in surface waters. Frequently this is done before the filtration step so that residues can be removed.

A slight excess of chlorine is usually desirable in the finished injection water to prevent growth in the well bore and injection-face area. However, oxidizable or chemically reactive matter other than that which it is desirable or necessary to treat may be present in appreciable amount.

Such matter might include inorganic ions (i.e., sulfide, ferrous) or organic materials in solution (present or added for control of other bacteria or of corrosion). The former could waste excessive amounts of chlorine, and destruction of the latter would defeat the purpose for which they were added.

Maintenance of chlorine residual levels is complicated by a lack of specificity of analytical methods which often indicate an apparent residual which is not fully effective in killing the microorganisms present.

Organic biocides . . . Quaternaries, amines, chlorinated phenolics, aldehydes, and other items (marketed under a variety of proprietary names) may be used to control various bacteria, especially sulfate-reducing bacteria, not subject to control by chlorine. Ideally, these should be truly dissolved in the water at the injection point so that they do not add to the plugging problem.

Extensive thought and experimentation have been devoted to the problem of bacteria, especially sulfate-reducers, in water-injection systems. A special API subcommittee has been studying it for some time. Our own

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INFORMATION REQUIRED ON WRITTEN ORDER

Typical examples showing proper sequence and abbreviated nomenclature

Identification of Fittings not required on order	Quantity	Size	Degree	Weight or SCH No.	Radius	Material	Name
90° Elbows, Long Radius	10	1"	90°	STD	LR		WeldELLS
90° Elbows, Short Radius	14	2"	90°	X-STG	S R		WeldELLS
45° Elbows	6	3"	45	XX-STG			WeldELLS
90° Reducing Elbows	4	4x2"	90°	STD			Reduc WeldELLS
90° Long Tangent ends	3	5"	90°	X-STG			WeldELLS, Tan one end
180° Returns, Long Radius "Barb ends	2	6"	180°	STD			WeldELLS, Tan both ends
180° Returns, Short Radius	8	8"	180°	LIGHT WALL	LR		WeldELLS
Tees, Straight	12	10"		STD	S R		WeldELLS
Tees, Reducing	16	12"		SCH 40		See	Tees
Reducers, Concentric	3	14x14x10"		SCH 20		①	Reduc Tees
Reducers, Eccentric	1	16x14"		SCH 30		below	Cen Reduc
Lap Joint Stub Ends	2	12x8"		SCH 60			Ecc Reduc
Caps	9	18"		SCH 80			LJ Stub Ends
Crosses, Straight	14	10"		SCH 100			Caps
Crosses, Reducing	24	8"		STD			Crosses
45° Laterals, Straight	3	4x4x2x2"		X-STG			Reduc Crosses
45° Laterals, Reducing	2	4"		XH			Laterals
Welding Saddles	1	6x6x4"		X-STG			Reduc Laterals
Welding Sleeves	6	8" on 10"					Saddles
	21	6"					Sleeves
	30 sets						

① When ordering regular carbon steel fittings material need not be specified and fittings conforming to ASTM A234, Grade WPB, will be furnished. Any other material must be fully identified by applicable specification.

RANGE OF SIZES (Inches)

FITTING	STD & X-STG	XX-STG	LIGHT WALL & SCH 10 ①	SCHEDS 20, 30	SCH 40 ①	SCH 60	SCH 80 ①	SCH 100	SCH 120	SCH 140	SCH 160
90° Elbows, Long Radius	½-42	1 - 8	¼-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1 -24
90° Elbows, Short Radius	½-42	1½ - 8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1¼-24
45° Elbows	½-42	1 - 8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1 -24
90° Reducing Elbows	2 -16			8-16	12-16						
90° Long Tangent Elbows	1½-42			8-30	12-24						
180° Returns, Long Radius	1½-30	1 - 8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	1¼-24
180° Returns, Short Radius	1 -42	1½ - 8	¾-30	8-30	12-24	8-24	10-24	8-24	4-24	8-24	¾-24
Tees, Straight & Reducing ① ②	½-36	¾ - 8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1 -24
Reducers, Conc. & Ecc. ① ②	¾-42	¾ - 8		8-30	12-24	8-24	10-24	8-24	4-24	8-24	1 -24
Lap Joint Stub Ends	½-42	¾ - 8									
Caps	1¼-24	1 - 8									
Crosses, Straight & Reducing ① ②	1 -24	1 -24									
Laterals, Straight & Reducing ① ②											
Welding Saddles											
Welding Sleeves											

① Normal maximum reduction of Tees and Re... one nominal pipe size smaller than half ... large end size. For exceptions, see Catalog ... Maximum reduction of Reducing WeldELLS ... large end size.

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laboratory and fieldmen have been examining it from both the research and practical field standpoints. All of these studies are beginning to bear fruit and some conclusions can now be drawn.

While many sulfate-reducer bactericides now being used are effective biocides under laboratory test conditions, we have found none which are notably effective at practical concentrations under actual field conditions. Here again the problem is largely one of compatibility.

Many quaternaries are insufficiently toxic in brines containing hardness or relatively low concentrations of certain salts. At lower pH values the chlorinated phenols are insoluble. Perhaps most important, almost all of these agents, being quite surface active and used in very low concentrations for reasons of economy, are adsorbed on the small amount of suspended matter inevitably present. They are thus not completely effective.

Furthermore, although there are doubtless exceptions, we have yet to examine a field water-injection problem where careful diagnosis[1] shows clearly that sulfate-reducing bacteria are proliferating to the point of being definitely troublesome. Continued attention to the matter will no doubt eventually clarify the role of these organisms.

Scale preventives . . . Scale deposition is encountered frequently in both the surface-treating systems and the injection areas. Usually the scaling problem, as distinct from that due to simple accumulation of unremoved suspended matter, results from a condition of incipient precipitation of insoluble sulfates or carbonates.

This may have derived from the mixing of waters, changes in temperature or pH, or use of treating agents. Sequestering or dispersing chemicals may help substantially to improve injectability.

Corrosion inhibitors . . . The need for adequate corrosion inhibition is well recognized, since the potential damage by corrosion and its products to the distribution system and to the injection surfaces is obvious. Some of the available inhibitors, chosen with a view toward their suitability under the conditions which obtain in the whole complex injection system, are of distinct benefit in mitigating corrosion damage.

The operator usually would rather limit the chemical added to the clean injection water to a single material capable of serving more than one purpose (corrosion inhibition, detergency, scale prevention, biocidal action). In the use of such multipurpose agents it is essential that these added characteristics do not detract from the ability of the material to prevent corrosion, since this is ordinarily a major source of trouble.

Surface-tension depressants . . . Assuming otherwise-ideal injection water, there remains the problem of the impervious, tight formation through which it is difficult to force the best water. Surface-tension depressants may be a significant aid.

Several studies of the use of such materials have been made[2,3,4] and a patent[5] on their use has been issued. Although they serve the purpose well in specific instances, their economic effectiveness in general use is not established. Probably the complexity of other interfering factors obscures definitive evaluation of these materials.

Dispersants successful . . . These have in numerous cases shown marked benefit in restoring injection rates to or near original levels and in reducing injection pressures which had been increased in attempts to maintain the desired injection rates.[6] Such improvements toward original and favorable injection rates and pressures probably stem from the ability of the surface-active agents to disperse solid and immiscible-liquid accumulations at or within the sand faces of injection wells.

Thus, minute solid particles which may have been sufficiently small individually to pass through the pores of the formation may have formed bridges across the openings of these pores. Alternatively, such particles may have adhered to the walls of the pores by virtue of dissimilar surface electrical charges. Action of surface-active agents could be in disagglutinating such masses or in alternation of surface charges so that the particles became repellent to each other and to the pores of the formation.

Immiscible liquids may be emulsified or dispersed and carried into the formation. The continuous use of surface-active agents serves to achieve more economically somewhat the same end results as are produced by periodic injection well workovers involving backwashing and acidizing. When surface-active agents are used the insoluble matter is presumably carried deep into the formation instead of being brought to the surface.

When a program of dispersant-chemicals use is to be inaugurated on an already contaminated injection system the initial treating level should be low, with gradual increase to normal treating dosage. Otherwise, large quantities of sediment and debris may be dispersed from surface lines and tanks into the water stream.

To avoid possible plugging of wells by these impurities it may then be necessary, as shown in an accompanying case history, to divert the flow to emergency impounding areas. Where such cleaning of the system, including the injection well, is desired, the dispersant characteristics of these chemicals are employed by deliberate use of higher concentrations. This is followed by flushing or backwashing to waste pits.

Bentonite shrinkers . . . The swelling of bentonitic or montmorillinite clays by certain waters (especially fresh waters or low-calcium brines) has been encountered. If such swelling has not been allowed to plug injection wells completely, the swelling effect may be reversed.

An effective method involves use of acid to convert the swollen hydrated clays to the acidic, nonhydrated form. High-calcium brines may also be effective, particularly when used as flood waters following acid shrinking of clays.

Examples of Incompatibility

Here are a few specific examples of incompatibility which have come to our attention. The chemicals considered, all of them commercial materials provided by various suppliers, are coded and identified as to general type where possible. They are in common use in floods where they frequently serve a specific purpose admirably.

Effect of hard water . . . The bactericidal effectiveness of most compounds decreases at hardness levels found in saline flood waters. Tests made in our laboratory gave the results shown in Table 1. The decreased bactericidal activity of these products caused by hardness is sufficient to affect the economics of treatment in each case and in some cases a profound effect is apparent.

The method employed in the tests of Tables 1 and 2 shows the minimum concentration of a compound able to kill at least 99.9 per cent of a population of sulfate-reducing bacteria in 24 hours. The bacteria are exposed to a compound in aqueous solutions containing uniform (10,000 p.p.m.) salt concentration. The soft-water solution contained sodium salts only; the hard-water solution contained a mixture of sodium, calcium, and magnesium salts (identical anionic composition) yielding hardness equivalent to 5,000 p.p.m. expressed as $CaCO_3$.

Sikorsky S-58 pinpoints supplies at a jungle drill site. Earlier the rig itself was airlifted in sections to the site by helicopter. The S-58 will carry two tons of cargo in its Utility version.

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TABLE 1—COMPARATIVE EFFECTS OF SOFT AND HARD WATER ON BACTERICIDAL ACTIVITY

Bactericide type—	Minimum effective bactericidal concentration as p.p.m.	
	Soft water	Hard water
Cyclic amine (bactericide-corrosion inhibitor)	20	>1,000
Multile-purpose cationic bactericide, corrosion inhibitor, scale preventive	20	>1,000
Cationic corrosion inhibitor	10-20	>200
Aliphatic primary amine acetate	<1	4
Quaternary ammonium compound A	2	8
Quaternary ammonium compound B	2-4	15-20
Quaternary ammonium compound C	<2	4-6
Quaternary ammonium compound D	1-2	5-10
Quaternary ammonium compound E	1-2	5-10

TABLE 2—ACTIVITY OF BACTERICIDES IN THE PRESENCE OF DIFFERENT WATER-TREATING MATERIALS

Treating agent composition—	Minimum effective concentration (p.p.m.)
A. Phenolic bactericide alone	2.5-5
Amine-type corrosion inhibitor-bactericide	10-15
4.5:1 mixture of above products	>50

B. Effect of a multiple-purpose corrosion inhibitor, scale preventive detergent product (CSD) on activity of four bactericides.

Bactericide 1—Quaternary ammonium compound
Bactericide 2—Quaternary ammonium compound
Bactericide 3—Fatty amine, acetate salt
Bactericide 4—Chlorinated phenolic compound

Ratio bactericide to CSD (Per cent)	Minimum effective concentration of bactericide only, p.p.m.			
	1	2	3	4
100 : 0	3-4	2-3	5-7.5	<1
75 : 25	4	2-3	7.5-10	2
50 : 50	4-5	3	7.5-10	2
25 : 75	7.5-10	4.5	7.5-10	2-3
10 : 90	>12.5	5-7.5	10-12.5	>12.5

All other conditions were identical Since certain factors such as pH oxidation - reduction potential, nutrient components, bacterial strain, etc., were rigidly controlled but do not necessarily duplicate conditions in injected waters, these results should be considered comparatively.

Other incompatible mixtures . . . By means of the method used in these tests several bactericidal products have been found (Table 2) to be unfavorably influenced by the presence of other products used for the same or different purposes. This means that use of two bactericides, or a bactericide and a corrosion inhibitor, or a bactericide with a multiple - purpose product (corrosion inhibitor, scale preventive, detergent) may result in drastic loss of bactericidal effect.

Chlorine-treated system . . . A West Texas water flood had been employing a polyphosphate product to combat scaling, together with hypochlorite and ammonium sulfate to control biological growth. The dosage of biocide was controlled to maintain a 1 p.p.m. chlorine residual at injection wellheads. Tests had indicated corrosion in the system and an organic corrosion inhibitor was therefore introduced on a continuous basis.

Shortly after the initiation of the corrosion inhibitor treatment the 1 p.p.m. chlorine residual at wellheads disappeared. In addition, the water at these locations became turbid. Therefore the wells were shut in and the water was diverted to surface pits. Approximately a ton of sludge accumulated in the pits before the water ran clear and injection could be resumed.

Bacteriological surveys were being made during this period. Soon after these changes had occurred a drastic change in the microscopic flora of the water was observed. The water had not been free of bacteria prior to admission of the corrosion inhibitor. However, it soon contained increased numbers of bacteria; and large numbers of protozoa, known to feed on bacteria, were found.

These changes in microflora indicated the presence of additional debris in the system, which was undergoing decay in the altered environment resulting from the introduction of the corrosion inhibitor.

Fouled injection systems . . . Many cases of accumulation of unsuspected debris in supposedly clean injection systems have been noted. In one Oklahoma location a change in chemical to one with pronounced surface activity resulted in the loosening of sufficient sludge to temporarily plug two injection wells and thus necessitate workovers.

Inhibitor change . . . Source well for a water flood in Illinois had been treated by admission of sodium arsenite solution through the annulus of the well. This bactericidal treatment was stopped several days prior to initiation of an alternate treatment with a corrosion inhibitor having bactericidal activity. This product was admitted to the water in the same manner as in the previous treatment.

Soon after the calculated through-system time had elapsed it was noted that the water was visibly hazy. A filtration test showed the presence of a suspension of plugging solids in the water. Laboratory tests confirmed that water containing traces of arsenite or arsenate gave a hazy, filter-plugging suspension when mixed with the organic product at the concentration used in the flood.

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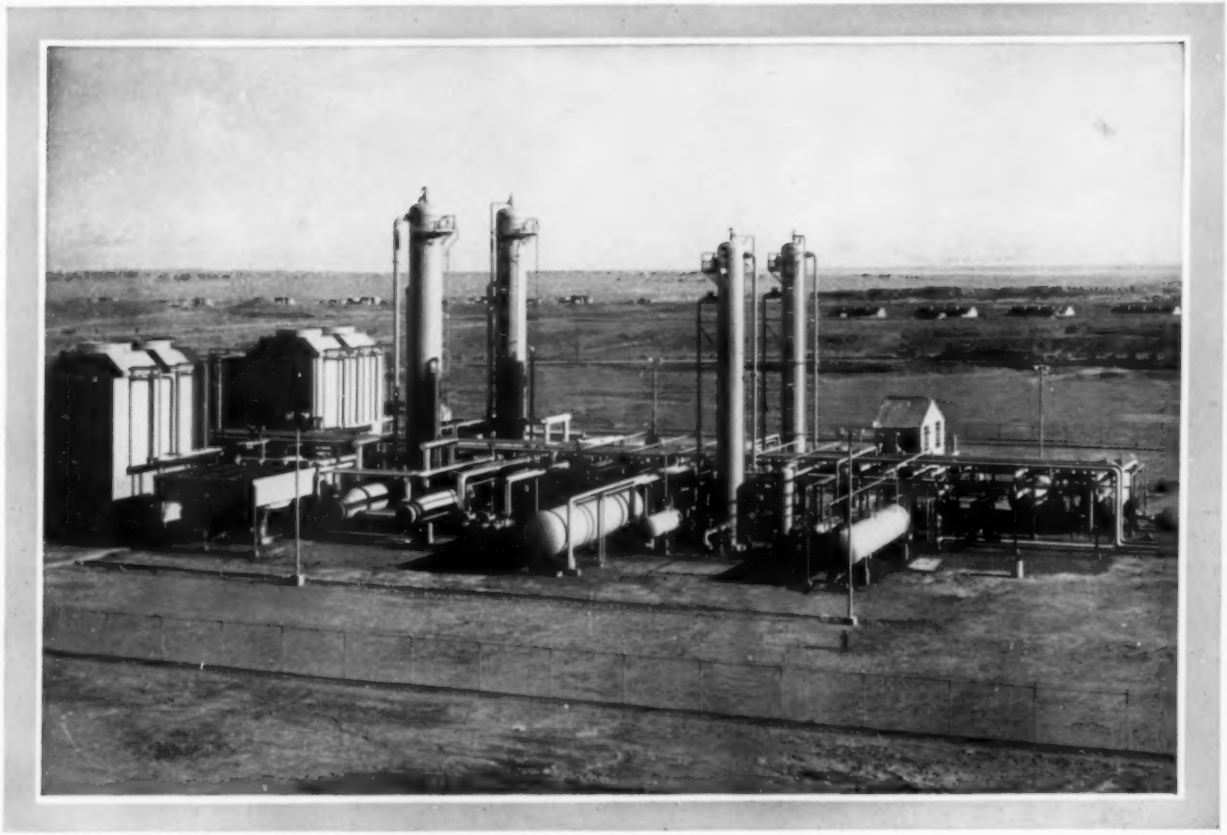

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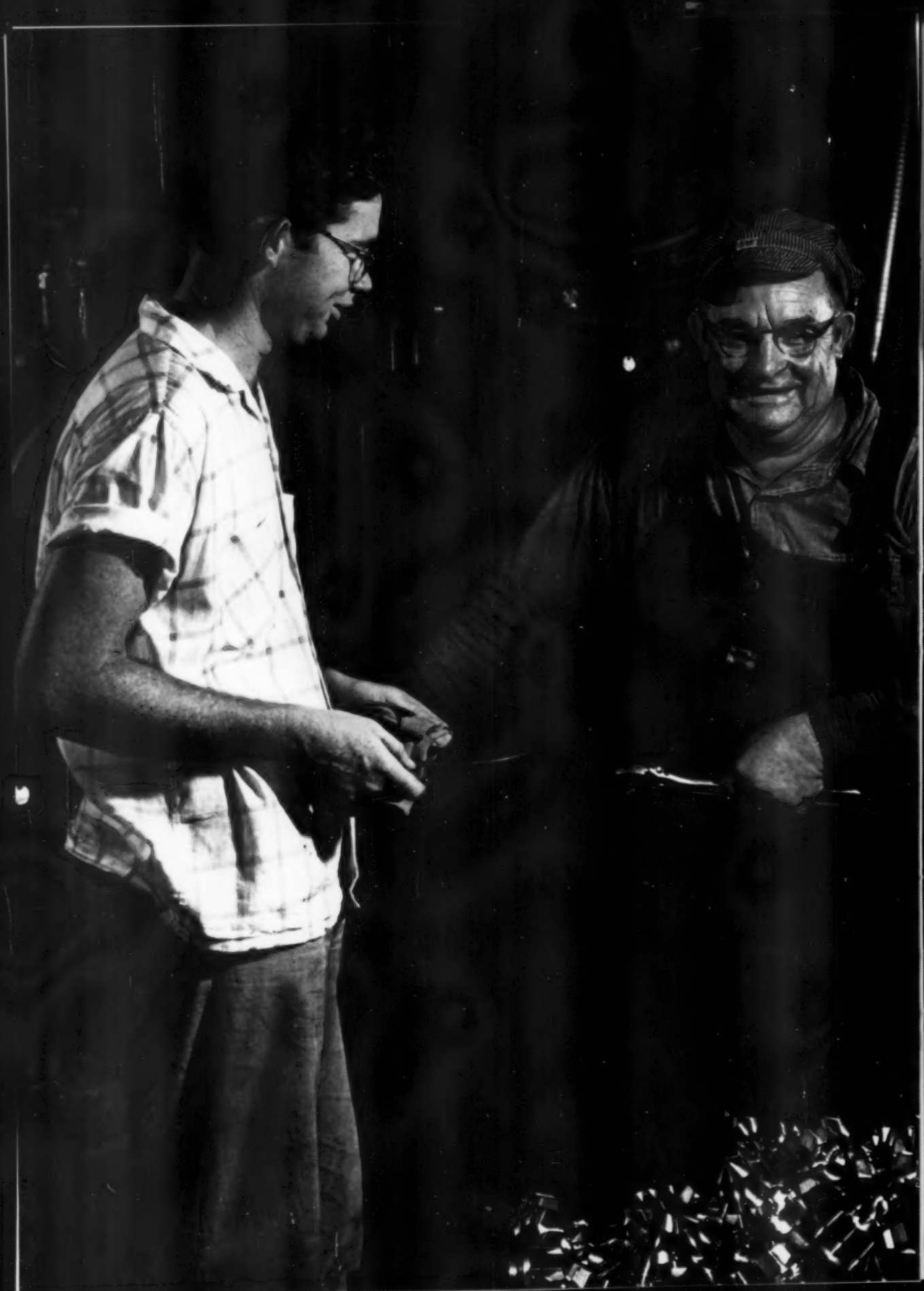

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When Machine Repairman B. N. Hitt talks about Reed manufacturing methods, son Carlton Hitt listens with respect. B. N. Hitt started at Reed in 1929, and for 29 years has been in an ideal spot to observe the constant development of Reed's production facilities and processes.

Mr. Hitt recalls that when he first joined Reed every bit cutter was actually a "hand-made" job. One man put one cutter at a time through each necessary machine operation to completion—machined the blank piece of steel, milled the teeth, and then ground the bearing race.

Using these methods, Reed turned out the finest rock bits of that era. In 1929 Reed was showing the way to longer bit life and increased footage per bit with the first roller bearing (anti-friction) rock bit.

Modern plant machinery and production line techniques have long since replaced these "job shop" methods. Today, Reed Y Bit cones like those in the photograph move along production lines in quantity lots. Each step of the manufacturing process is controlled by skilled, experienced craftsmen in charge of modern, precision machines.

The Reed Y Bits produced by the facilities and methods of today are, like the "hand-made" Reed Bits of 1929, the finest of their era.

Production techniques have been modernized and product designs have changed. But you can be sure of this: The high standard of Reed quality has been, and will remain, unchanged through the years.

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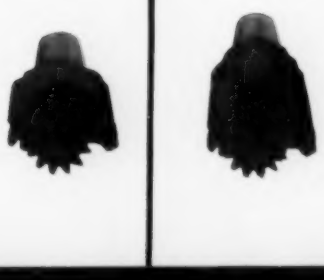

Machine Repairman B. N. Hitt, shown talking to his son, has been with Reed 29 years. His son, Carlton Hitt, has been with the company a year.

C. E. Williams, Gulf Sales Engineer, Midland, Texas, and G. W. Ramsey, Assistant Plant Superintendent, inspect force feed lubricators on one of the modern gas engines at the Goldsmith plant of El Paso Natural Gas Company.

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REFINING

"What the industry needs is an entirely new approach to the problems of

SOLIDS WASTE DISPOSAL

Maybe we can find a good answer before our clay pile crowds us out of the refinery."

BY S. O. BRADY

THE PROBLEM OF spent clay and sludge disposal is an enormous one. To date no entirely satisfactory method has been devised for disposal.

In the introduction of Chapter 6 of Volume I of the API Manual on Disposal of Refinery Wastes we find the following statement: "The disposal of sludges and spent clays has always been a problem in the petroleum refining industry, and the need for a satisfactory solution to this problem has long been recognized. In the past such practices as 'dumping' and 'ponding' have predominated."

Fig. 1 is a good illustration of both of the "dumping" and "ponding" procedures. This is the accumulation of many years. Formerly the spent clays were hauled to the site in gondola cars and unloaded by a clam-shell bucket, as can be seen in the foreground. Currently, spent contact clay is slurried and pumped to the settling ponds in the background.

Among the meanings Webster lists for the word "disposal' is to transfer anything into new hands or to arrange. This material has been transferred to a new location and arranged in a neat pile so you might call this disposal. However, more and more the waste-disposal engineer things in terms of **ultimate disposal** or completely getting rid of a waste, and in the light of that type of thinking the dumping and ponding suggested in the manual are not waste-d i s p o s a l methods.

Author is with Humble Oil & Refining Co., Baytown Tex. Paper presented at second annual waste disposal conference, Wichita, Kans.

How Much?

Some idea of the size of this problem can be obtained from the quantity of solids wastes produced. Table I lists the pounds of solids wastes produced per calendar day from each of the four principal sources.

This 235,000 lb. or over 117 tons is a lot of mud of any kind; and when it is soaked with oil and water, it is a Texas-size headache.

Separation

We can obtain a more complete picture of the magnitude of this problem by considering the extensive and expensive facilities required just to separate these solids from the various oil and water streams in the refinery. It should be borne in mind as we discuss these wastes and the separation facilities which we have installed to handle them, that even with all of these facilities, we have not disposed of anything. However, separaton is the first step and a very important one in the disposal process.

Solid Wastes

Four sources of oil-coated solids wastes were listed in Table I. In order to complete the picture it will be well

TABLE I—PRODUCTION OF OIL-COATED SOLIDS

	Pounds per calendar day
Contact lube clay	166,000
Floc sludge from waste chemical treatment	39,000
Filter cake from slop-oil emulsion filtration	26,500
Separator sediment	4,000
	235,000

HERE'S BOTH DUMPING AND PONDING. These practices represent two forms of disposal, but not what the engineer calls "ultimate disposal."

to discuss these sources individually to show where the solids originate and indicate the facilities that have been installed to separate and segregate these materials.

1. Contact Lube Clay

This is an old problem in the refining industry, but relatively few refineries have found completely satisfactory solution to the problem of disposal of the used contact clay. These used clays are sometimes burned and reused, but their treating efficiency usually drops with each reburning and they have to be discarded after a few cycles. If they are discarded after burning they present few problems. Spent contact clay has in some cases been charged to fluid catalytic cracking units as makeup catalyst.

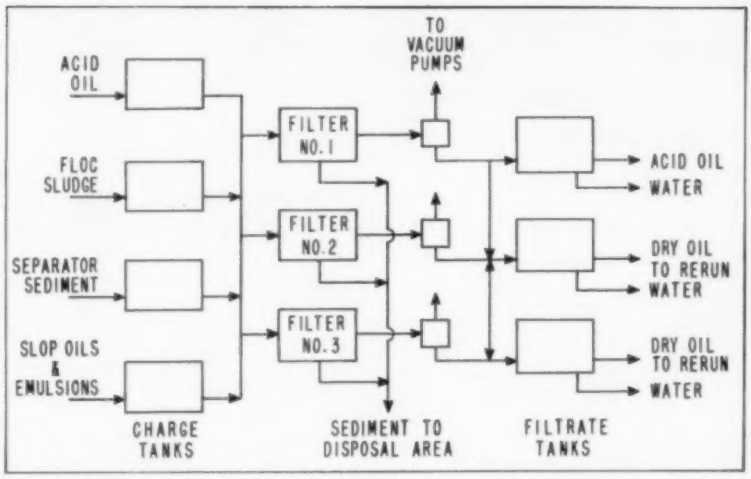
Pile it high . . . In the majority of cases this material has just been stored in an ever-increasing pile. This has been the case at Baytown as is shown in Fig. 1. Facilities have been installed to slurry these clays in water and pump them to the settling basin. On the surface, mixing these clays with water appears to be a step in the wrong direction, but it is justified by the much cleaner and healthful working conditions at the filter house. Experience has shown that the clay settles readily in the settling pond resulting in a relatively clean water effluent. Although clay contacting of lube oils is the largest producer of oil coated solids, the expenditures for handling the waste are nominal because the solids are segregated as produced.

Quit producing the waste . . . At Humble, we are firm believers in the theory that the best way to solve any difficult waste-disposal problem is to quit producing the waste. Results from extensive research on this particular problem indicate that we can soon eliminate, or at least greatly reduce, clay contacting by replacing it with a better process for neutralizing and decolorizing lube oils.

2. Floc Sludge from Waste Chemical Treatment

The next source of solid wastes listed in Table 1 is the sludge resulting from clarification of neutralized waste chemical streams. Weak acidic and alkaline waste streams from the entire refinery are collected in a segregated sewer system. The combined stream is acidified to a pH of approximately 2 in order to "spring" organic acids, and is then pumped to an impounding basin that has approximately 1 day's retention time.

Coagulation . . . Organic acids that rise to the surface in the impounding basin are skimmed off and the water is clarified in a conventional flocculation process as shown in the schematic flow diagram in Fig. 2. Lime and sodium aluminate are used as the flocculation agents. Boiler-water treating sludge is added to the coagulator and serves as a very effective weighting agent for the floc. This material is collected from the boiler-water treaters in a special piping system and is stored in a tank adjacent to the coagulator.



ORGANIC ACIDS that rise to the surface in the impounding basin are skimmed off and the water is clarified in a conventional flocculation process as shown in this schematic flow diagram. Fig. 2.

Approximately 5 tons of this material is produced each day and before the collection system was installed the sludge was discharged to the sewer system where it resulted in the formation of large quantities of solids stabilized emulsions and increased the production of separator sediment. The floc sludge which now contains the boiler-water treating sludge is filtered to remove water and is hauled in gondola cars to the clay pile for storage.

3. Filter Cake from Oil Emulsion and Separator Sediment Filtration

Since the solids that stabilize emulsions in the sewer-separation system and the solids that settle to the bottom of the separator come from common sources, they will be considered together.

Separator solids . . . The solids that are removed from a gravity oil-water separator come from a variety of sources. Approximately 20,000,000 gal. of river water is brought into the refinery each day to supplement well water for cooling. On the average, this water will contain 5 tons of silt per day. A portion of this silt will become oil coated and form emulsions that are skimmed from the separator, and part will become agglomerated with other solids and settle to the bottom of the separator. The bottom sediment is scraped to sumps and is pumped off.

B.s. and w. . . . Sediments entrained in the incoming crude oil as b.s. and w. also contributes solids to the problem. If the crude charge tanks are operated on low suction the b.s. and w. is charged to the desalters with the crude, in which case much of the solids are discharged to the sewer with the desalter brine and are removed from the separator. If the b.s. and w. is allowed to settle out in tankage some of it is discharged to the sewer in periodic water withdrawals. If the sediment is removed from the crude charge tanks by periodic cleaning, it is placed directly in the stable slop oil emulsion system and is removed at the slop oil filters.

Filter clays . . . Large quantities of filter clays and finely divided catalysts are used in the refinery and some of this material is washed to the sewers along with coke and scale during normal washing up around the units. Sand and silt are washed into the sewers during runoff following rains. If care is not exercised to control pH in the sewers, chemical floc or precipitates are formed in the sewer-separator system by interaction of chemicals in various streams.

In many old refineries the sanitary sewage is discharged into the same sewer system as the process wastes, and the sewage solids contribute to both the formation of emulsions and the quantity of bottom sediment in the separator. Recognizing this fact, Humble installed a complete sanitary-

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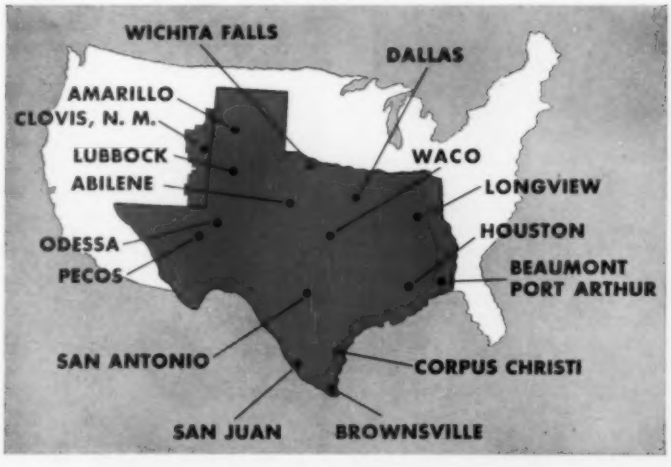

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F DIESEL ENGINES

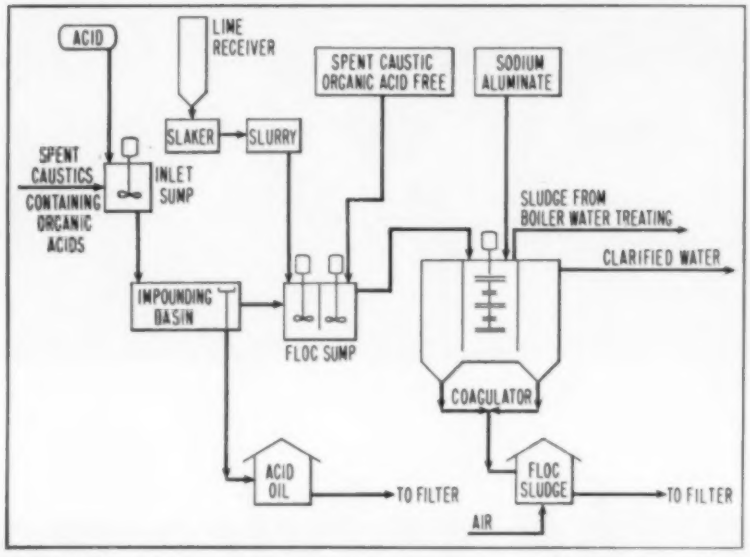
sewer system and sewage-treating plant consisting of primary settling, trickling filter, secondary settling, and chlorination.

Separator bottoms . . . The sediment from the bottom of the separator is scraped to sumps and is pumped off in a water slurry containing 5 to 10 per cent solids. The slop oil skimmed from the separator contains small amounts of both emulsified water and finely divided solids. These solids normally stabilize the emulsions.

Clarifiers . . . Extensive skimming and scraping equipment is required to remove the sediment and slop oil from the separators. This equipment consists of four rectangular clarifiers having a span of 70 ft. and a traverse of 270 ft. each. A smaller clarifier is installed in the inlet chamber to the separator. These clarifiers skim oil from the surface while traveling one direction and scrape sediment from the bottom while traveling in the reverse direction. In addition to the clarifiers; tankage, lines, and pumps must be installed to move these wastes to new locations for further processing.

Filtration plant . . . In order to remove the solids from the emulsion and thereby resolve them to recover the oil, a filtration plant has been constructed consisting of three 400-sq.-ft. rotary vacuum precoat filters. This plant is so designed that not only the stable slop oil emulsions, but the separator sediment and floc sludge from the waste chemical clarification can be filtered. Very little oil is recovered by filtering the latter materials, the operation being conducted primarily for dewatering. Capacity for filtering the acid oil recovered from the impounding basin was included in the installation. However, this operation is seldom necessary since the acid oil can usually be dewatered by heat settling. Fig. 3 shows a schematic flow diagram for the filter installation.

Decreasing separator sediment . . . To those familiar with the problems of separator sediment production in a refinery, the 4,000 lb. per day shown in the table will probably seem low. Ten years ago that figure was close to 10,000 lb. per day, but by separately treating all chemicals, thereby preventing floc formation in the sewer system, installing a complete sanitary sewer collecting and treating system, and by educating operators, we have reduced the production of separator sediment to the figure shown.



FILTRATION PLANT is so designed that not only the stable slop-oil emulsions but the separator sediment and floc sludge from the waste chemical clarification can be filtered. Fig. 3.

Properties of Sludges

Physical and chemical properties of sludge will vary widely from refinery to refinery due to the different processes in use. However, some typical analyses of these sludges may help to emphasize that even after such treatment as filtration, the residual material may be a difficult one to handle and one which still presents disposal problems.

Where Do We Go From Here?

From the remarks up to now, it is obvious that the large capital investment involved in providing facilities for separation and segregation of the oil-coated solids still has not provided a satisfactory answer to the problem of disposing of these materials. The question now is, "Where do we go from here"? If plenty of low-cost land is available in or near to a refinery, storage may be the most practical answer. In a majority of eastern refineries, however, land is not only scarce but very expensive, and industry is being pressed to find a better solution to the problem.

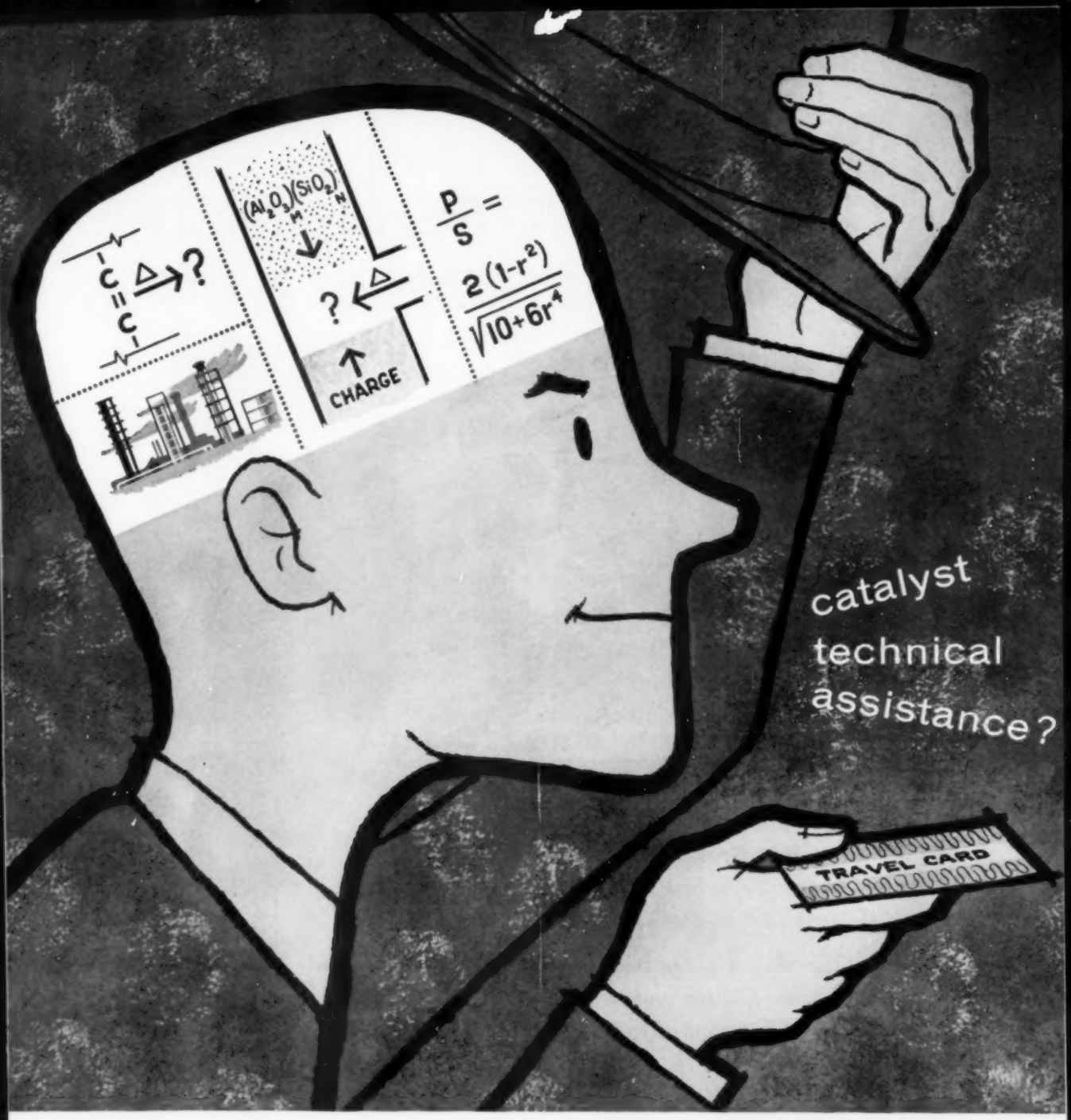
Dump it at sea . . . One solution to the problem that has been used is to haul the sludge to sea and dump it in water deeper than 100 fathoms. This has been done with some chemical sludges but this procedure is quite expensive. One major oil company is successfully blending spent clays with natural clay soil to achieve a very stable fill material. Incineration of these sludges to remove the oil is another disposal method that has been used. Investments for incinerators of this type have in the past been quite large and maintenance costs have also been high. Such investments have been extremely difficult to justify in this highly competitive industry. Some of the newer type incinerators now appearing on the market do show much promise.

Top-soil mixing . . . As an example of one of the many, many different disposal schemes that have been investigated, we have even tried mixing various oil-coated solids into the top soil of some of the unused land in the refinery area in order to determine how long it would take the soil bacteria to stabilize the oil in the sludges. For certain wastes this is a fairly inexpensive disposal method, but a prohibitive amount of land would be required to handle our entire production of oil-coated solids.

What the industry needs is an entirely new approach to the problem of solids waste disposal. Maybe we will find a good answer to our problem before our clay pile crowds us out of the refinery.

ANALYSES OF OILY SLUDGES

Source—	Per cent by weight— Oil content	Sediment	Water
Contact lube clay (settled from slurry)	6.2	49.8	44.0
Floc sludge	23.8	57.6	18.6
Slop oil and sediment filter cake	29.1	48.9	22.0



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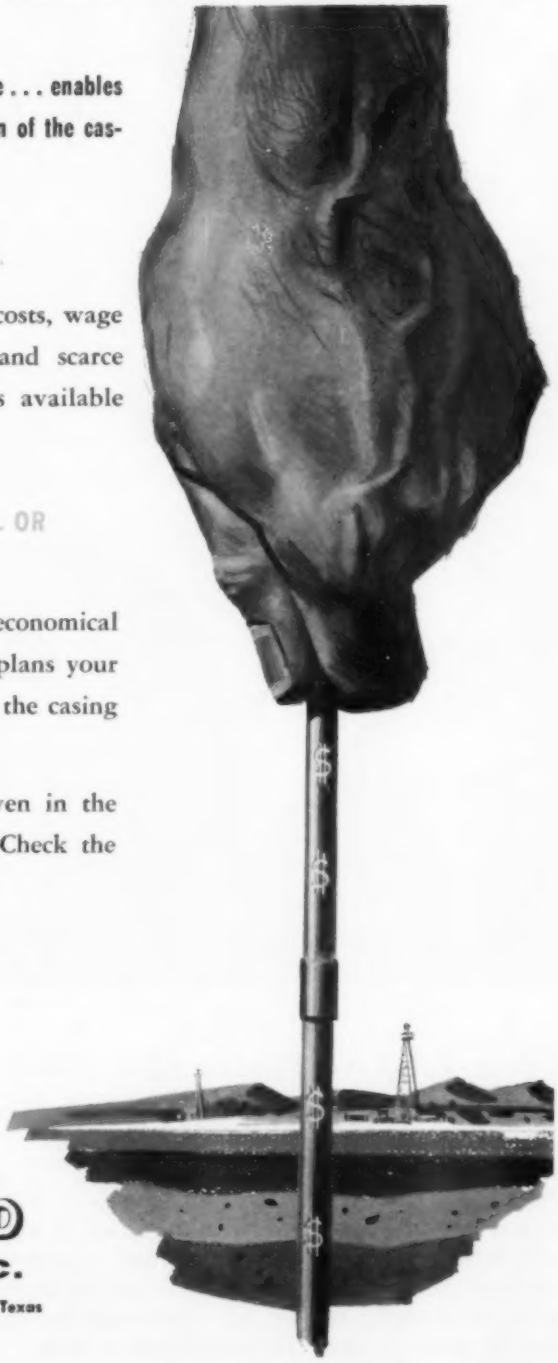

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TURBODRILL is seen hanging in the derrick in view at left, while the view at right shows a closeup of the turbodrill, which is manufactured in France. British Petroleum Co. conducted the experiments described here in Egmanton field, England. Operator used 8⅝-in. drill bit.

COMPARISON: Turbodrill and conventional bit

What it showed:

- Turbodrills average 45 to 50 ft. per hour against 24 to 25 ft. by conventional rotary.
- Turbodrills use more bits per footage drilled.
- More frequent bit changes actually increased overall drilling time for the turbodrill on one well.

BY E. LAWSON LOMAX, petroleum consultant, London

TESTS were recently conducted by British Petroleum Co., Ltd., in the established Egmanton field in Nottinghamshire between turbodrill units and conventional drilling units. Two turbodrill units were used in separate wells, and two conventional rigs were used in two other wells, each rig drilling in similar formations for comparison purposes and optimum results.

The turbodrills were made in France by Ets. Neyrprie, being 7¼-in. o.d. models using an 8⅝-in. drill bit and carrying 125 stages of rotor and stutor units. The pumping equipment for the turbodrills comprised two National C-250 pumps each powered by a 400-hp. Paxman engine, delivering 500 g.p.m. (U.S.) at a surface pressure of 1,300 psi.

The mud used was a straight bentonite/water mix of 1.18 sp. gr., viscosity 36 sections (Marsh) and a maximum sand content of 1.2 per cent. The operator experienced no difficulty in clearing cuttings from the bottom of the hole. However, the

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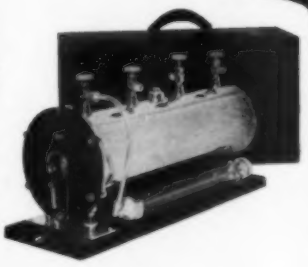

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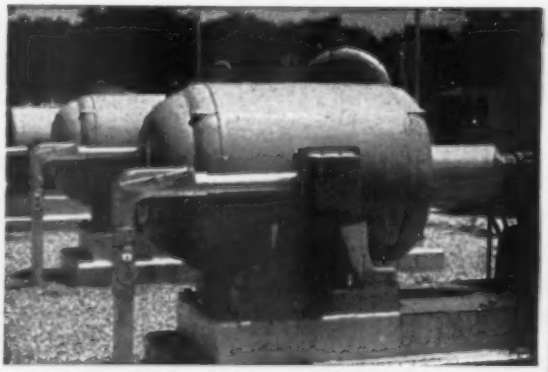

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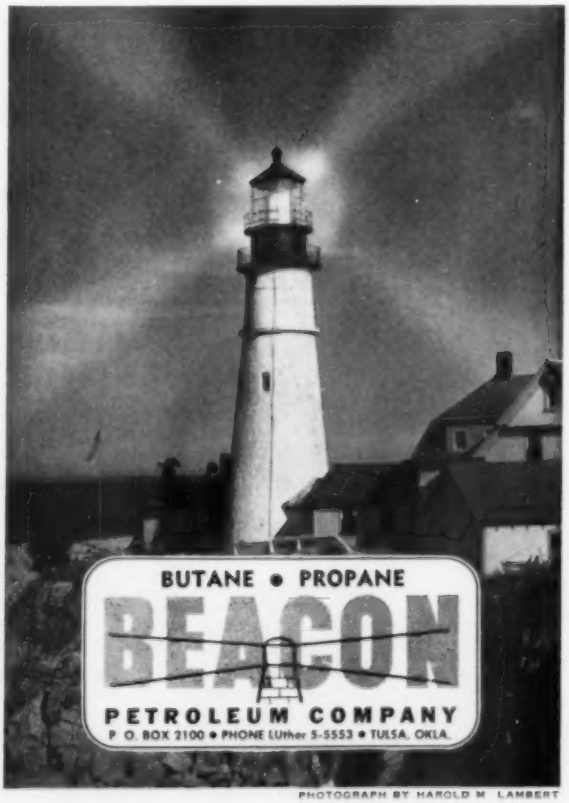
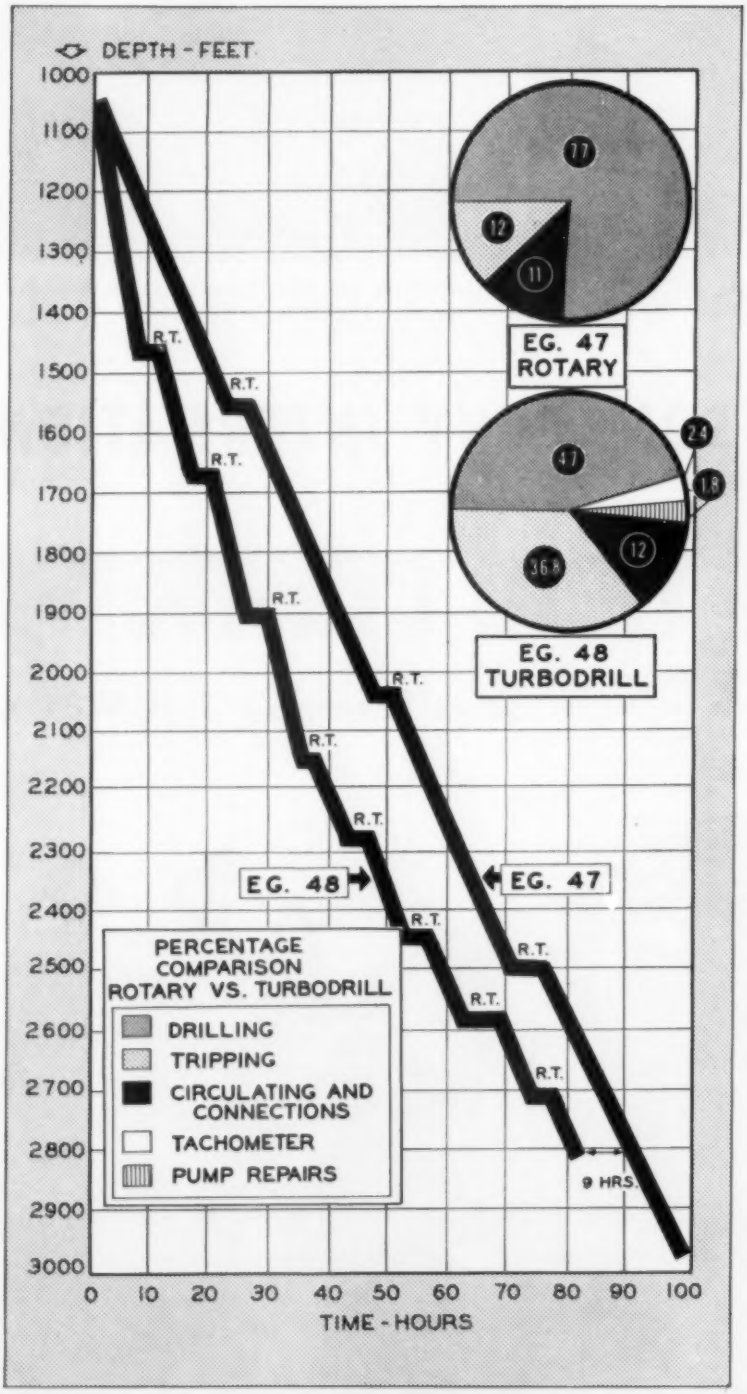


PHOTOGRAPH BY HAROLD M. LAMBERT



COMPARISON between the turbodrill and the conventional rotary. Because of the wear and tear on bits and round trips, much of the advantage in penetration rates was lost with the turbodrill.

cuttings were very small and were not very satisfactory for geological study.

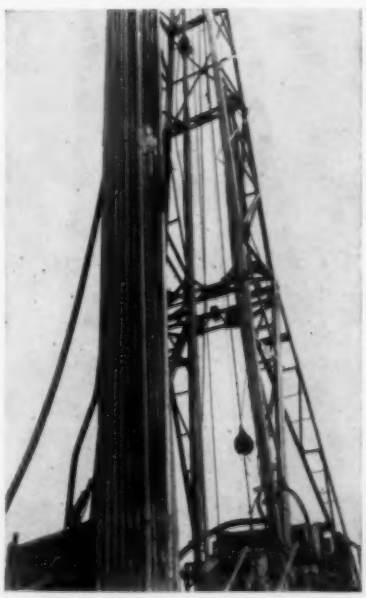
The operator was interested in checking various types of bits for comparison purposes. Some of these were experimental models that were fitted for special bearings but with conventional teeth. These special bits showed no advantage over the standard types during these tests. These bit studies, however, will be carried further.

The maximum weight carried on the 8⅝-in. turbobits during the test was about 24,000 lb. During much of the drilling, however, low weights were used to prevent the hole from drifting off the vertical. During the comparative tests the section drilled in each case was from 1,100 to 2,800 ft. In this section, the turbodrills averaged 45 to 50 ft. per hour. This was almost double the drilling done by conventional rotary rig that averaged 24 to 25 ft. per hour.

The conventional rotary used only four bits in each of the holes. With the turbodrill, nine bits were used in one hole and six bits in the other. This, of course, forced the operator to change bits more frequently in the turbodrilled holes. As a result, the over-all drilling time was increased, and present tests by B.P. reveal very little advantage in over-all drilling time when comparing the turbodrill to conventional drilling.

There is a distinct possibility that better all-around results might have been accomplished if weights of 24,000 lb. had been used all the time on the turbobits. But this greater weight would have lowered the revolutions of the turbines and thus have reduced the rate of wear on the bits and turbodrilling bearings. B.P. noted that the wear on the turbodrill bearings appeared to be unduly high.

The company conducted experiments to determine the true speed of rotation of the turbodrill. B.P. indicated that the results were interesting, and further testing is planned. In addition, B.P. plans to continue testing the turbodrill in other areas where drilling conditions should be more suitable to the economic use of the turbodrill.



TURBODRILL at bottom of drill collar.

All the Calvert mud and cementing trucks plus one carrying welding equipment are towed across the plowed field to the job site by the TD-18.

The 20,000-lb draw works is maneuvered into the desired location across the cut up field by the TD-18 and Carco winch.

5 REASONS WHY INTERNATIONAL

"best oil field crawler we

says foreman J. B. Walker of

Here the 30,000-lb mud pump is spotted next to a completed pit with a big assist from the TD-18 crawler and winch.

Final operation by the crawler consists of hoisting the 96-ft mast into an upright position above the drill platform.

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Calvert's International TD-18 hurriedly cuts out two 38 and 45-ft slush pits and a 35 x 35-ft reserve pit in the frozen ground. Using the inside mounted 'dozer with less overall width, permits them to move the rig from job to job without dismantling, and stay within highway limitations.

The far-flung jobs of Calvert Drilling, Inc., Albion, Ill., have one thing in common: on-schedule completions. The power that pushes schedule completions in five fields in Illinois, Colorado, and North Dakota is supplied by five bonus-powered International TD-18 oil field crawlers.

Here is one of Calvert's TD-18's wrapping up an entire job in a field near St. Peter, Ill., in just 24 working hours. The TD-18 tows in supply trucks...punches out pits...spots the draw works and mud pump...and winches up the 96-ft. mast.

Foreman J. B. Walker reports: "This new 182 series TD-18 is the best oil field crawler we've ever used. Has both power and unmatched operating ease. It's a tractor we depend on to keep the operation on schedule. It's the company's 8th TD-18 in the last 8 years operation. All have proved their work ability under every condition possible with very low downtime."

Compare the job-speeding drawbar pull you get from a TD-18—right on your drill site. Measure International crawler Cerametallic clutch action, for operating and servicing ease—power-transfer efficiency—long life. Inspect International's new full-floating track roller seals with the 500-hr lube interval. Examine the new full-flow lube oil filters with 480-hr capacity. Prove flush-deck safety, "Control Tower" visibility, new booster steering, as production aids.

See your International Construction Equipment Distributor for a new Bonus-Powered crawler demonstration. He can fill your every oil field power need—from an International Drott TD-6 4-In-1 to a TD-24 that gives you famous Planet Power steering with full-time "live" traction-matched power on both tracks.

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

How Suntide Refining blends products in tanks holding up to 200,000 barrels

Some of the largest tanks ever mixed can be found at Suntide Refining Company's plant in Corpus Christi, Texas. Suntide performs a variety of blending operations in these tanks—equipped in some cases with *five* LIGHTNIN Mixers.

Many of these LIGHTNINs have been in service for four years, blending a wide variety of products: diesel oil, crude, jet fuel, and leaded gasoline. Suntide reports that the mixers have operated continually during that time *without a single failure* of any part including the mechanical seals.

Low-cost maintenance

A mechanical seal, optional equipment on any new LIGHTNIN Side Entering Mixer, is one feature of the mixers installed at Suntide Refining. It can save refiners thousands of dollars per year on big tank mixer maintenance.

The LIGHTNIN Mechanical Seal Mixer eliminates stuffing box repacking, and *never* needs shaft seal adjustment. And the seal can be replaced in a few minutes —even under a full head of liquid in the tank—without dismantling or removing the mixer from the tank!

Exact mixing results

Not all tanks require five large side entering mixers, of course. In many cases, only one LIGHTNIN will blend products to full uniformity in a matter of minutes.

Your LIGHTNIN representative can tell you exactly what mixing action is required to do the job at your refinery. His recommendations are based on data accumulated over many years of Mixco research.

Get just-right mixing in all of your tanks—big or small—by installing LIGHTNIN Mixers. For more information, contact your nearest LIGHTNIN Mixer representative (he's listed in Composite Catalog). Or write us direct.

"These mixers have been running since October 1953, without a single failure of any part including the mechanical seals," says transfer foreman Ray B. Dunn. He's referring to the LIGHTNIN Mixers installed at Suntide Refining Company's Corpus Christi plant.

Lightnin® Mixers

MIXCO fluid mixing specialists

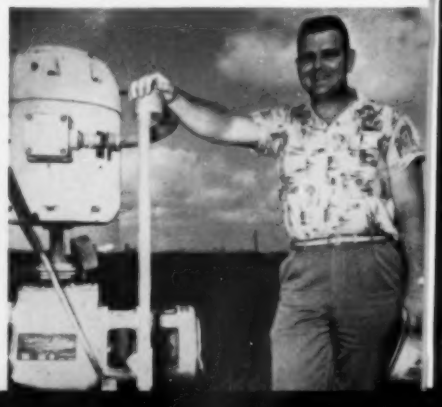
FOR LATEST MIXING INFORMATION and full description of LIGHTNIN Mixers, send for these helpful bulletins:

- ☐ Side entering: 1 to 25 HP (B-104)
- ☐ Top or bottom entering; turbine, paddle, and propeller types: 1 to 500 HP (B-102)
- ☐ Top entering propeller types: ¼ to 3 HP (B-103)
- ☐ Portable: ⅛ to 3 HP (B-108)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ LIGHTNIN Rotary Mechanical Seals for extra low cost mixing
- ☐ LIGHTNIN Mixers for controlling B.S.V.W. (B-503)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Data sheet for figuring mixer requirements (B-107)

Check, clip, and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc., 174-c Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.



At one southwestern plant . . .

Magnesia insulation gives temperature control

BY P. R. AUSTIN

A DOUBLE LAYER of 85 per cent magnesia insulation covers process vessels and piping for improved temperature control, increased heat savings, and added fire protection at a large Southwest natural-gasoline plant.

Because operating temperatures in this and other natural-gasoline plants are under 600° F., single-layer insulation could have been used. However, the company felt that the increased economy and safety resulting from a double layer of magnesia on pipes and vessels operating over 400° F. would more than offset the additional installation cost.

The plant has a capacity of 190 M.M.s.c.f.d. of gas and operates on an around-the-clock, 7-day schedule—producing gasoline, isobutane, kerosine, LPG, and fuel oil. Process steam is generated in three outdoor boilers and enters the plant through 10-in. lines at 522° F. and 305° F.

Two layers of 1½-in., 85 per cent magnesia insulation are used on all process vessels and exchangers operating over 400° F. Those operating under 400° F. are covered with a 2-in. single layer of magnesia.

Single layers of sectional insulation are applied to all high-temperature, small-diameter pipelines and to larger lines carrying fluids at less than 340° F. Double-layer sectional insulation is used for those applications calling for insulation 2 in. thick or greater. Thickest insulation used is 3 in., made up of two 1½-in.-thick layers. The schedule of pipe insulation thicknesses for this installation is listed in Table 1.

Joint openings due to expansion of hot vessels or piping are prevented by properly installed double-layer insulation. The outer layer is located so that side and end joints are staggered with respect to the corresponding joints in the first layer. Both block and sectional insulation were applied by this method, which prevents heat loss through paths which could otherwise open directly from the hot metal surfaces.

Author is partner, Fuller-Austin Insulation Co., Houston.

All insulation is finished and covered to minimize maintenance. Block insulation, whether single or double-layer, is held in place against vessel shells with 12-gage galvanized steel wire. Two finish coats are used: the first of ½-in.-thick insulating cement; the second, ⅛-in.-thick asphalt weatherproofing. Finally, each vessel is covered with a jacket of 0.024-in. corrugated aluminum sheet. Sheets are lapped at least 3 in. at seams, and are held together with aluminum screws on 4-in. centers.

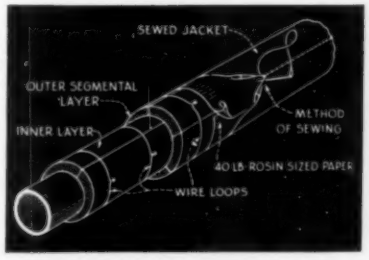
Each section of pipe insulation is fastened securely with three or more loops of 16-gage galvanized wire. Indoor pipelines are covered with 8-oz. sewed canvas jackets. Outdoor piping is jacketed with 0.020-in. aluminum sheet, lapped 3 in. at joints. Laps are made downward to shed water and keep the insulation dry.

In addition to insulation for processing economy, the plant also is insulated for operator safety. For this purpose, a 1-in. covering of 85 per cent magnesia is applied wherever surface temperatures exceed 125° F. This protective covering is applied to a height of 7 ft. above grade or work-platform level.

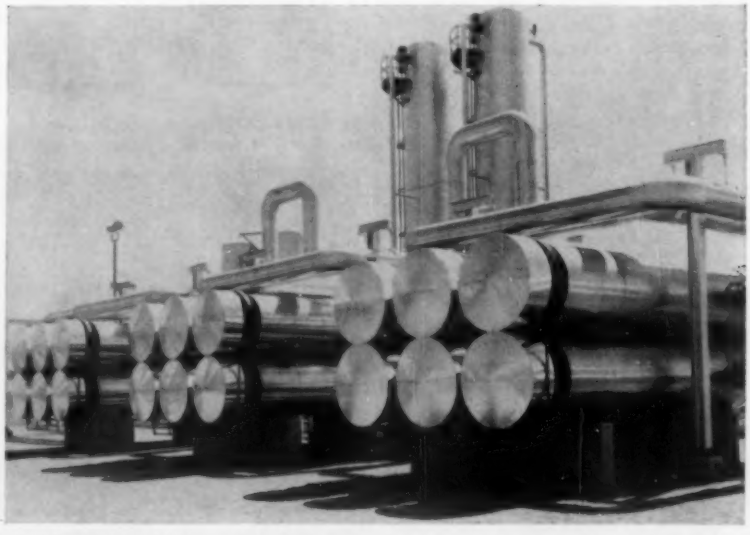
TABLE 1

Thickness of Ehret Thermalite 85 Per Cent Magnesia Pipe Insulation at Southwest Natural Gasoline Plant (In.)

Operating temp.—	Nominal pipe size— Under 2 in.	2 to 4 in.	Over 4 in.
Under 266° F.	1	1	1
267°-337° F.	1	1	1½
338°-387° F.	1	1½	2
388°-499° F.	1½	2	2½
500° F. or over	2	2½	3



INDOOR PIPING is covered with double-layer sectional magnesia.



HEAT EXCHANGERS are sheathed with aluminum over magnesia insulation for process economy and safety.

Pure Oil Co. refinery has found

Two ways to distribute lube oil

BY LARRY RESEN
District Editor

A LUBE-OIL distribution system and a counterpart lube-oil pressure-feed system are in operation at Pure Oil Co.'s Nederland, Texas, refinery.

Both were developed primarily from salvage equipment and represent a minimum expenditure. Both are resulting in improved plant housekeeping and safety.

The pressure-feed system is in operation at the MEK dewaxing unit. It is used to supply lubricating oil to lubricators on five dewaxing filters, three ammonia compressors, and two inert-gas compressors. The equipment consists of a pressured oil-storage tank, ½-in. distribution lines to each lubricator, and an individual valve on the lube-oil outlet at each lubricator.

The pressure tank was made up by taking two heads from an old exchanger and welding a short length of pipe between them to form a horizontal drum with a capacity of about 35 gal. The drum is loaded through a 2-in. connection at its top. An air line is also tied in at the top and provides the necessary pressure on the system.

The drum is pressured to 60 lbs. by plant instrument air reaching it through a pressure-reducing valve. The plant instrument air-which normally is held at 115 lb.—was selected as the pressuring medium since it is dry and clean and will not contaminate the oil. An outlet at the bottom of the pressure tank directs oil into the ½-in. distribution system and pressure is maintained thereby on the entire system. Whenever an operator has to fill a lubricator, he merely cracks a valve and oil enters the lubricator.

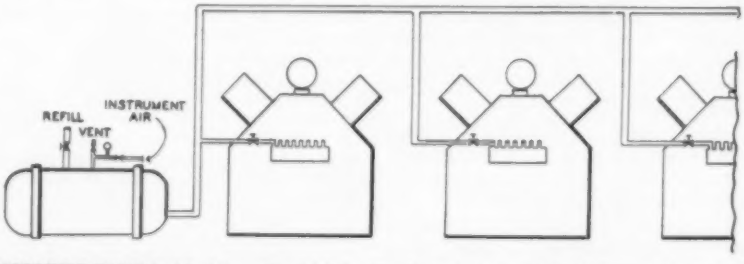
This system eliminates the need for manhandling oil containers at the individual lubricators—these are all elevated. It also eliminates the need for carrying oil to the individual pieces of equipment, some of which are on a second level. Both of these advantages contribute to better housekeeping and safety. Since the system is closed, dirt is kept out of the oil, preventing contamination.

The system also tends to insure that lubricators are kept sufficiently full. When an operator checks and finds one low, he can fill it at that instant. There is no delay while he goes to get an oil container. And there is no chance that something will interfere to cause an extended delay before he returns.

The plantwide distribution system is unrelated physically to the pressure system, but it also is designed for improved housekeeping and safety. It was installed to cut down on the use of drums at various units throughout the refinery. Four salvaged tanks were set up adjacent to the grease-compounding and lube-oil-blending plant as a central storage point. Steam pumps are used for transferring the oil which is stored in 350, 500, 2,400, and 4,000-gal. tanks. The four most common grades of oil used at the plant are stored in these tanks.

An old tank truck was converted to transport the oil from the tanks to the units. It contains five compartments, each with 160-gal. capacity. A warehouse helper makes deliveries to small storage tanks—275 gal. each—at each operating unit three times weekly. This method insures an ample supply of oil and a minimum number of storage tanks.

INSTRUMENT AIR is used to pressure lube oil through ½-in. lines.



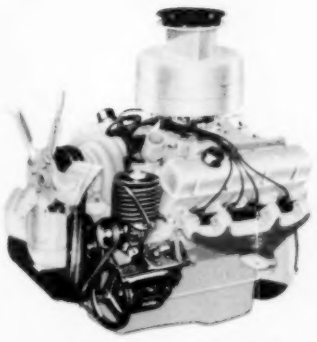
PRESSURE TANK holds lube oil which is distributed to individual pieces of equipment at the turn of a valve at each lubricator.

CENTRAL STORAGE at refinery is in these four tanks, holding four different grades of oil. An old tank truck transports the oil to individual units.

FORD

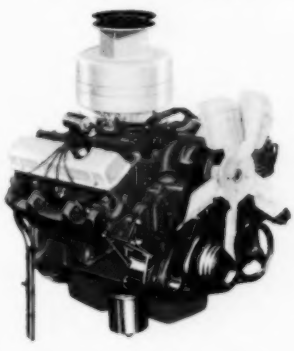
1958 EXTRA HEAVY DUTY TRUCKS
WITH NEW SUPER DUTY V-8'S

C-850
C-950
C-1000
C-1100



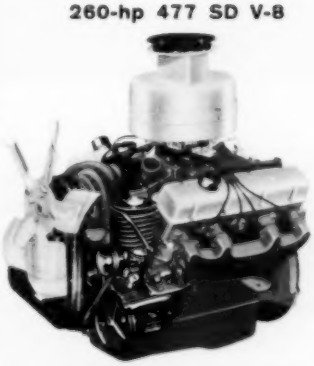
277-hp 534 SD V-8

F-850
F-950
F-1000
F-1100



260-hp 477 SD V-8

T-850
T-950



226-hp 401 SD V-8

BIG TRUCK BUILT...BIG TRUCK POWERED...AT FORD'S LOW PRICES!

FORD TRUCKS COST LESS

...LESS TO OWN ...LESS TO RUN ...LAST LONGER, TOO!

NEW FORD EXTRA HEAVIES

FORD T-950 tandem dump truck with up to 51,000-lb. GVW, up to 277-hp Super Duty V-8 available. GCW 75,000 lb.

FORD C-1000 Tilt Cab tractor with big 260-hp Super Duty V-8 engine. Maximum GCW 65,000 lb. with optional axle, GVW 31,000 lb.

FORD F-1100 conventional with 277-hp Super Duty V-8 standard. Maximum GVW 36,000 lb. with optional 29,000-lb. rear axle.

Step in . . . the new Ford Extra Heavy Duty trucks for '58—the all-new, more rugged line with huge payload capacities for on-highway or off-the-road service. *Step ahead* with Ford's more-for-your-money features. Meet America's most modern *big* trucks for '58. Discover the new advances in this pace-setting Extra Heavy Duty line of Conventionals, Tilt Cabs and Tandems.

They're new in power, too! Ford now offers three mighty new Super Duty V-8's. Extra rugged, modern big engines with up to 534-cubic inch displacement . . . up to 277 horsepower! And "over square" (bore larger than stroke) Short Stroke design provides maximum power, durability and economy.

Saddle-type, step-type and cylindrical fuel tanks are available, complete with electric fuel pumps for extra dependability. Mighty Super Duty engines and Ford Extra Heavy Duty chassis form a combination of power and ruggedness that can't be beat. Springs, axles, brakes—all components are engineered to give exceptional service. All the new Ford advancements for '58 mean *Ford Trucks Cost Less* . . . less to own . . . less to run . . . last longer, too!

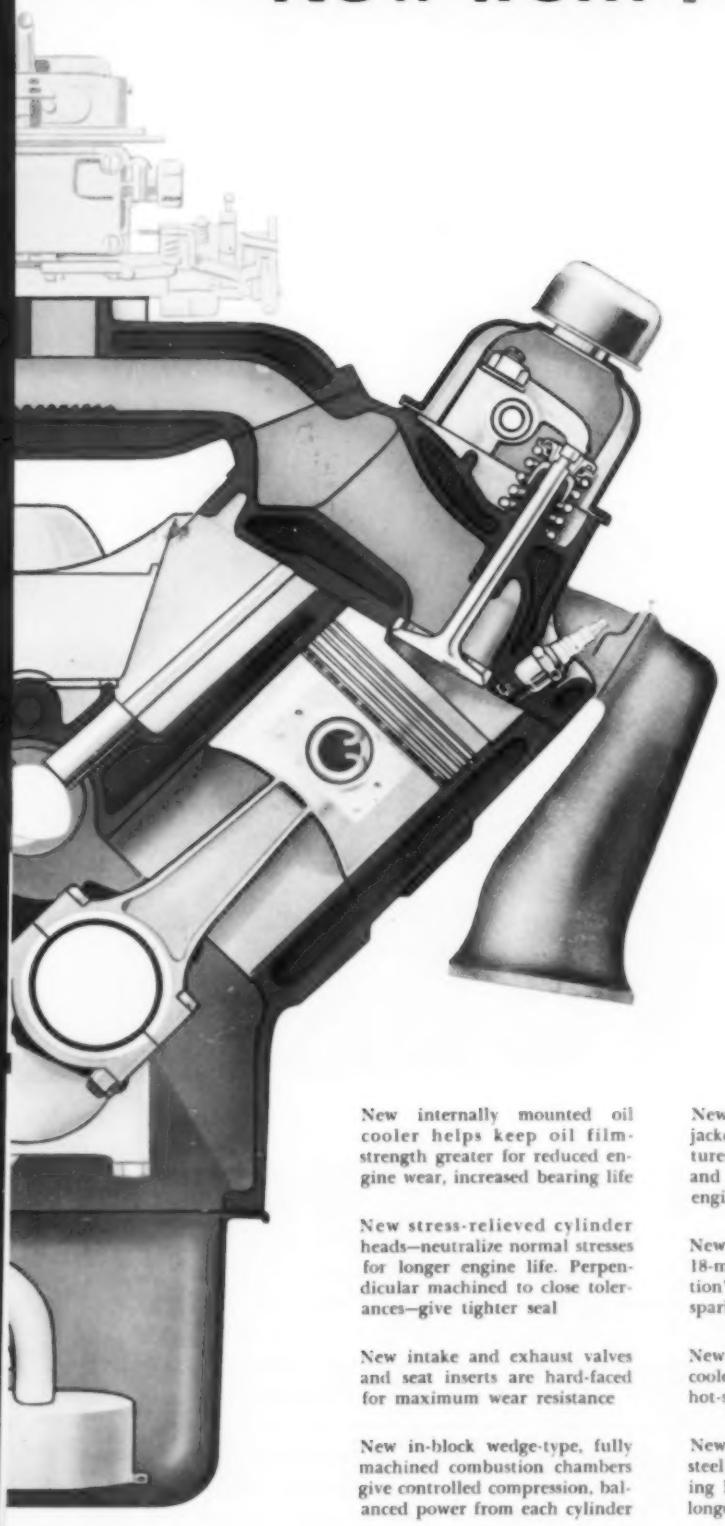
QUICK FACTS

CONVENTIONAL MODELS	ENGINE		REAR AXLE		MAX. TIRES	GVW'S (lb.)		GCW'S (lb.)	
	Standard	Optional	Standard	Optional		Standard	Optional	Standard	Optional
F-1100	277-hp 534 V-8		22,000 lb.	29,000 lb.*	12 x 24.5—12 PR	30,000	36,000	65,000	
F-1000	260-hp 477 V-8		21,000 lb.	22,000 lb.	12 x 24.5—12 PR	30,000		55,000	65,000
F-950	226-hp 401 V-8		21,000 lb.		12 x 24.5—12 PR	29,000		55,000	
F-850	226-hp 401 V-8		18,000 lb.		11 x 22.5—12 PR	25,000		50,000	
TILT CAB MODELS									
C-1100	277-hp 534 V-8		22,000 lb.	29,000 lb.**	12 x 24.5—12 PR	31,000	36,000	65,000	
C-1000	260-hp 477 V-8		21,000 lb.	22,000 lb.	12 x 24.5—12 PR	31,000		55,000	65,000
C-950	226-hp 401 V-8		21,000 lb.		12 x 24.5—12 PR	30,000		55,000	
C-850	226-hp 401 V-8		18,000 lb.		11 x 22.5—12 PR	26,000		50,000	
TANDEM MODELS									
T-950	226-hp 401 V-8	260-hp 477 V-8 277-hp 534 V-8	38,000 lb.		12 x 24.5—12 PR	46,000	48,000 51,000	75,000	
T-850	226-hp 401 V-8	260-hp 477 V-8 277-hp 534 V-8	34,000 lb.	28,000 lb.	11 x 22.5—12 PR	43,000	37,000 45,000	— 70,000	55,000 —

*Not available on 132" wb. model.

**Not available on 99" wb. model.

Now from FORD . . . durable



Big, modern all-truck engines! Up to 534-cu. in. Displacement . . . 277 Horsepower for New Ford Extra Heavy Duty Models

New Ford Super Duty V-8's have up to 534-cubic inch displacements . . . up to 277 horsepower for rugged performance. Three great new "over square" (bore larger than stroke) Short Stroke V-8 truck engines for new Ford Extra Heavy Duty models. The most modern, most efficient gasoline engines in their field. They're ultra-modern . . . designed for today's hauling needs.

Engineered to develop more horsepower per pound, with rugged new durability features for longer-lasting dependability. And for routine maintenance their clean, simple design gives maximum accessibility for servicing. Powerful new Ford Super Duty V-8's have been thoroughly road tested by leading truck fleets, coast to coast . . . they're ready to bring you new power, durability and economy!

New internally mounted oil cooler helps keep oil film-strength greater for reduced engine wear, increased bearing life

New stress-relieved cylinder heads—neutralize normal stresses for longer engine life. Perpendicular machined to close tolerances—give tighter seal

New intake and exhaust valves and seat inserts are hard-faced for maximum wear resistance

New in-block wedge-type, fully machined combustion chambers give controlled compression, balanced power from each cylinder

New intake manifold—water-jacketed for stabilized temperatures . . . aids high horsepower and torque output, improves engine economy

New spark plug accessibility—18-mm. plugs with "Turbo Action" resist fouling, give positive spark action

New alternately spaced sodium-cooled exhaust valves reduce hot-spot dangers, last longer

New externally balanced, forged-steel crankshaft equalizes bearing loads for greater durability, longer bearing life

New Turbulence-Top pistons for maximum power, top ring groove carrier for extended groove life and thermal-controlled integral strut for better piston sizing

New, stronger "pyramid" connecting rods—hollow-milled for better balance

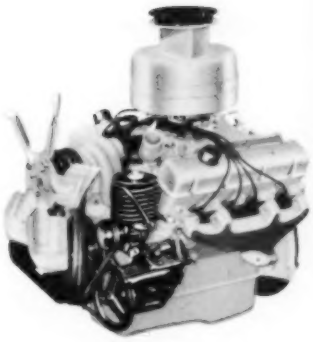
New extra-large Full-Flow oil filter—big 2-quart capacity for double filtering area

New high-capacity rotor-type oil pump mounted within the oil pan for more efficient lubrication system

FOR INDUSTRIAL ENGINE APPLICATION WRITE TO: INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION OF FORD MOTOR CO., P. O. BOX 598 DEARBORN, MICHIGAN

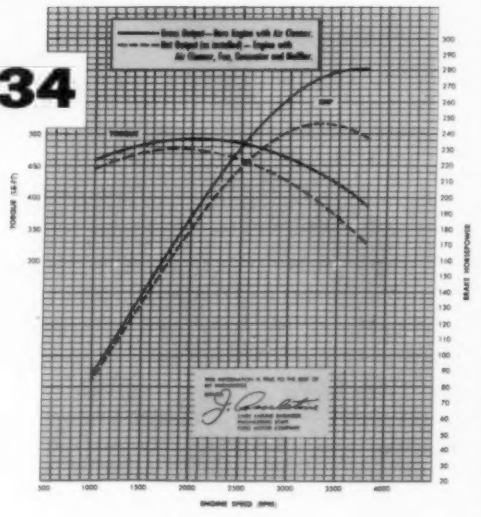
new Super Duty power

534



277-hp 534 SD V-8
Brake Horsepower—277 @ 3400 rpm
Torque—490 lbs-ft @ 1800-2300 rpm
Bore—4.50 in. **Stroke**—4.20 in.

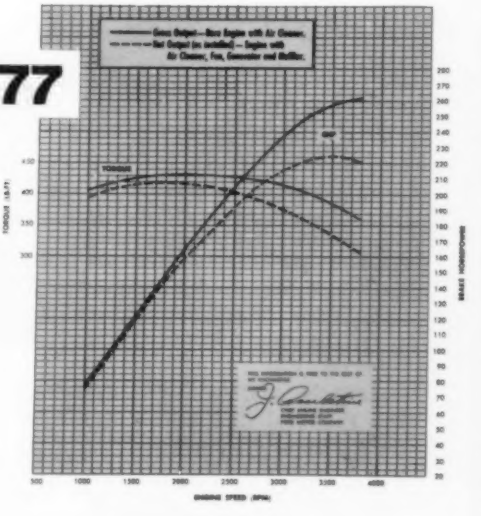
The big, new Ford 534 is an "over square" Short Stroke engine, like all Ford Super Duty V-8's. Here's snappy power, long-lasting durability and top economy. Standard in Ford F-1100, C-1100 trucks. Optional in T-850, T-950 tandems.



477

260-hp 477 SD V-8
Brake Horsepower—260 @ 3600 rpm
Torque—430 lbs-ft @ 1800-2300 rpm
Bore—4.50 in. **Stroke**—3.75 in.

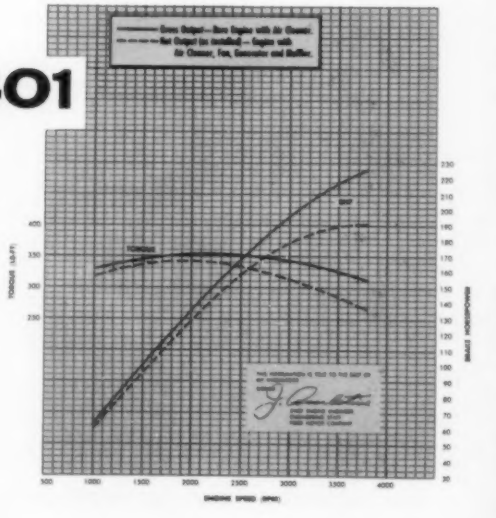
Now . . . 477 cubic inches of super power for your Extra Heavy Duty needs! Notice the high and flat torque curve (power curve at right) to insure maximum performance. Standard engine in Ford F-1000, C-1000 trucks. Optional T-850, T-950 tandem models.



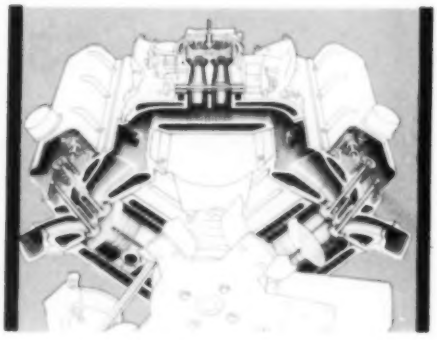
401

226-hp 401 SD V-8
Brake Horsepower—226 @ 3800 rpm
Torque—350 lbs-ft @ 1800-2300 rpm
Bore—4.12 in. **Stroke**—3.75 in.

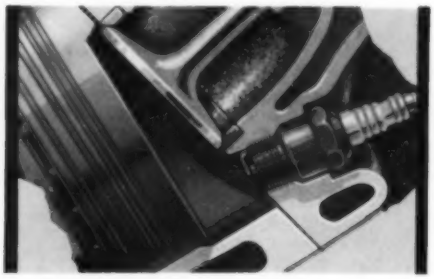
For higher earnings every trip, Ford Super Duty V-8's like this popular 401-cubic inch engine provide the best horsepower to weight ratios obtainable in comparable all-truck engines today. Standard in Ford F-, C- & T-850 and 950 models.



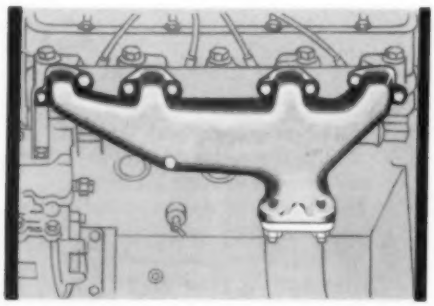
Outstanding new FORD V-8



NEW INTAKE MANIFOLDING—Much of the exceptional performance of Ford's new Super Duty V-8's can be traced to their free-breathing design. Thermostatically controlled carburetor air intake, Super-Filter air cleaner, 4-barrel carburetor, simplified intake manifold with water-jacketed passages and large intake valves—provide high intake efficiency. The modern single-bridge intake manifold distributes the fuel-air mixture more evenly for smoother performance. And its water-jacketed passages provide a more uniform fuel-air temperature.



MACHINED COMBUSTION CHAMBERS—New wedge-shape combustion chambers are fully machined for accurate volume and compression control. Completely in the block, there's less heat in the heads for improved valve cooling. The face of the head is flat-machined at 90° for positive mating with the block. The new wedge-shape chamber design together with Turbulence-Top piston heads gives better fuel-air turbulence for snappy power and minimized combustion deposits, and advanced "over square" (bore larger than stroke) Short Stroke engine design increases usable horsepower and torque . . . cuts internal friction for long engine life and greater fuel economy.



LOW BACK-PRESSURE EXHAUST MANIFOLDING—Improved exhaust manifolding reduces back pressure . . . means more usable power and longer engine life. For full performance, burned gases must be properly removed to make room for a fresh charge of fuel-air mixture. And on the new Ford Super Duty V-8 engines exhaust gases leave through large exhaust ports, down wide passages in the cylinder head to the generously sized exhaust manifolds and out dual exhaust pipes to complete the breathing cycle most efficiently.

DESIGN features

MODERN 3-STAGE PARALLEL FLOW COOLING

1. HEAD – For cold starts, both thermostats are closed and the coolant is pumped through the cylinder head and manifold water jacket, returning through a bypass to the pump. This restricted flow continues until the coolant reaches 140°. The rapid head warm-up preheats the fuel-air mixture for more efficient burning and greater power. Fast block warm-up also occurs, warming the oil for better lubrication.

2. HEAD AND BLOCK–At 140°, the back thermostat opens allowing coolant to circulate more rapidly through the block. The coolant flows through the head, block and intake manifold water jacket, but closed front thermostat prevents it from flowing through the radiator. It returns through a bypass to the water pump and is recirculated. This continues until the coolant in the intake manifold reaches 160°.

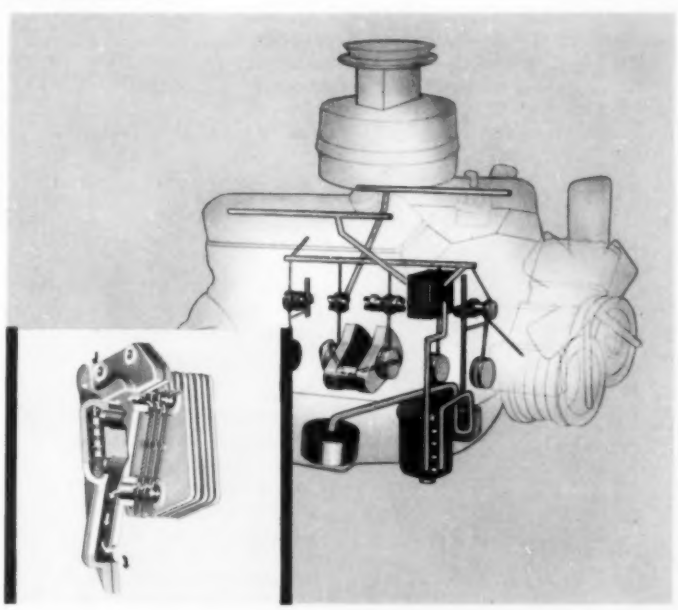
3. COMPLETE COOLING – At 160°, the front thermostat opens allowing the coolant to flow through the radiator and the entire cooling system. Approximately half of the coolant is directed to the heads and the other half to the block. This 3-stage system gives fast engine warm-up and effective cooling. Over ten thousand gallons of coolant per hour are pumped by the durable, high-capacity water pump.

NEW LUBRICATION SYSTEM

FULL-PRESSURE LUBRICATION SYSTEM – Oil is pumped under pressure through galleries in the block and head to the crankshaft main and connecting rod journals, camshaft journals, rocker shaft and arms, air compressor and timing gears. Valve stems, cam lobes, piston pins and valve lifters are effectively splash and gravity lubricated. Squirt holes in the connecting rods direct oil to cylinder walls.

Troublesome external oil lines have been virtually eliminated. And all oil is filtered passing through the large 2-quart Full-Flow oil filter.

INTERNAL OIL COOLING–A tremendous "plus" of the Ford lubrication system is the easily accessible internally mounted oil cooler. Standard equipment on all Super Duty V-8's, it's designed to keep the engine's oil at proper temperatures in extra-heavy-duty service. The oil cooler reduces oil temperatures to minimize carbonization . . . promotes greater oil film-strength . . . prolongs moving part life, main bearing, etc. . . . and extends time between oil changes.

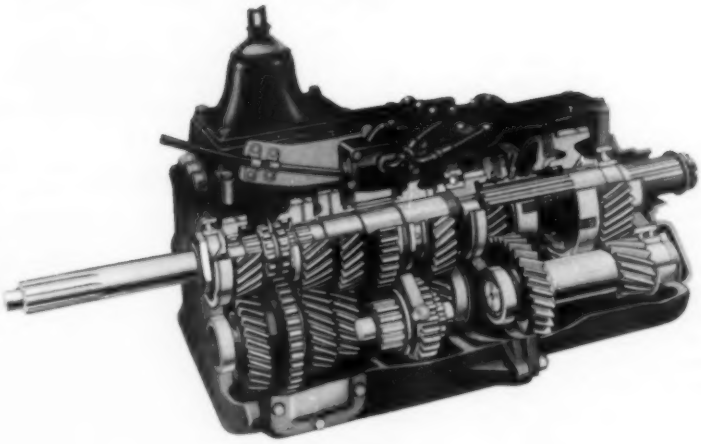


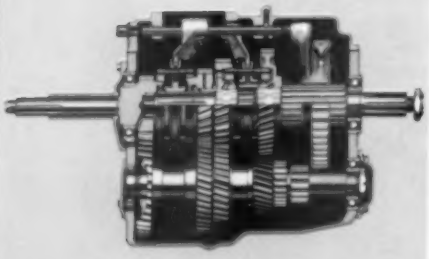
TWO-PLATE 13" CLUTCH – New, solid dual disc 13-inch clutch provides dependable, positive operation. Direct pressure is applied to the pressure plate by 12 coil springs. And the large facing area with two-plate design gives high torque capacity and long service.

For your extra-heavy-duty needs, Ford offers a wide selection of power train components designed for your individual requirements. Extra strength and capacity is engineered into each and every part to take the tremendous horsepower and torque output of the new Ford Super Duty engines . . . and to stand up under the big payloads Ford Extra Heavy Duty trucks are rated to haul. Transmissions, auxiliaries, clutches and Single- or Two-Speed rear axles are all engineered for outstanding performance and long, dependable service.

Extra strength in every

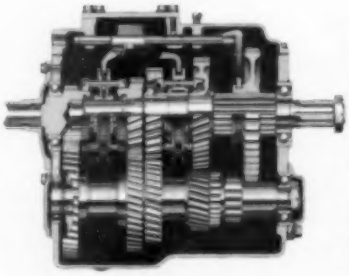
8-SPEED ROADRANGER – Designed for extra-heavy-duty over-the-road service, the Roadranger transmission provides 8 evenly spaced, progressive gear ratio steps. A four-speed constant mesh main gear box is coupled with an integrally mounted, synchronized Two-Speed reduction unit . . . giving 8 forward speeds to get loads under way faster and maintain highway speeds better. Shifting is powered by air, manually controlled by a convenient switch on the shift lever.





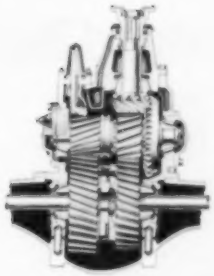
4000 SERIES SPICER TRANSMISSIONS

5-Speed Synchro-Silent, Direct-in-fifth transmissions are offered in a wide-ratio version, for use primarily with Single-Speed rear axles or with Two-Speed axles for off-the-road use. Close-ratio version for use with Two-Speed axles over-the-road.



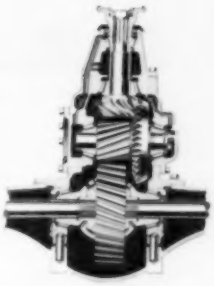
6000 SERIES SPICER TRANSMISSIONS

5-Speed Synchro-Silent, Direct-in-fifth or Overdrive-in-fifth (reduces engine revolutions about 17%) transmissions. Direct Drive is offered in both wide-ratio and close-ratio versions. Overdrive is close-ratio only.



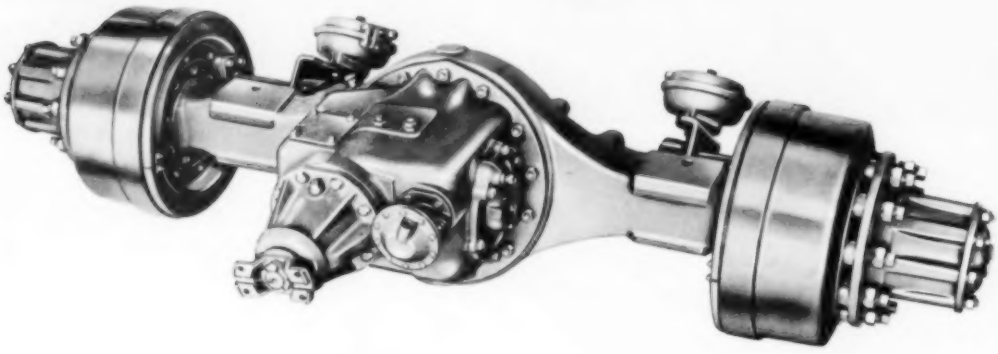
U-200

Rugged Single-Speed, double reduction, 29,000-lb. hypoid rear axle. Available with 6352 transmission on F- & C-1100 models. Not available on 99″ or 132″ wb. models.

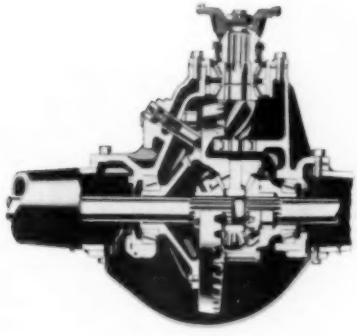


U-300

Big capacity Two-Speed, double reduction, 29,000-lb. hypoid rear axle. Available on F- & C-1100 models with 6352 transmission. Not available on 99″ or 132″ wb. models.

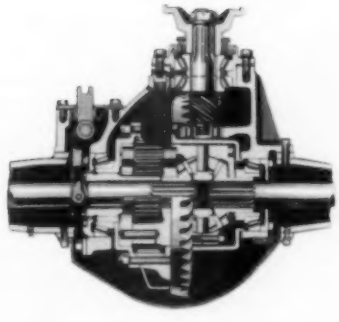


POWER TRAIN component



18,000-LB. SINGLE-SPEED
21,000-LB. SINGLE-SPEED
22,000-LB. SINGLE-SPEED

Spiral bevel, full-floating rear axle. Pinion is straddle-mounted for accurate alignment under high torque loads. All gears are alloy-steel, carburized and hardened for strength and wear resistance. And extra-capacity tapered-roller wheel bearings provide long, dependable service.



18,000-LB. TWO-SPEED
21,000-LB. TWO-SPEED
22,000-LB. TWO-SPEED

Spiral bevel, Two-Speed, full-floating rear axles. A planetary reduction gear set between the ring gear and differential provides two selective ratios for greater flexibility of truck operation. Easy to operate, positive-action, electric-shift control allows fast, easy shifting.

FORD Extra Heavy Duty

Double-Channel frame side rails provide a solid foundation for the bigger payloads and rugged dependability you get with Ford's Extra Heavy Duty models—both Conventional and Tilt Cab! Strong clean-cut chassis design pares away useless, unwanted dead weight, let's you carry more payload on every trip. Yet there's plenty of extra toughness where it counts. Ford's springs, frames and axles, unit for unit more durable, all have the reserve capacity to keep your loads rolling in all kinds of going.

F-850 Chassis Shown

C-950 Chassis Shown

CONVENTIONAL AND TILT CAB CHASSIS FEATURES:

Large-capacity flat tube-and-fin radiator with cylindrical top tank gives high cooling efficiency. Durable U-type rubber-cushioned support.

High-capacity, wide-tread, set-back front axle for shorter turning, more steering stability and improved weight distribution.

Durable tie-rod ends are spring-loaded, ball-socket type with dust shields, for automatic wear take-up.

Channel front bumper attached directly to frame, for greater rigidity.

Synchro-Silent type transmission is standard on all models to provide faster, easier shifting—up or down—with less loss of truck momentum, less driver effort.

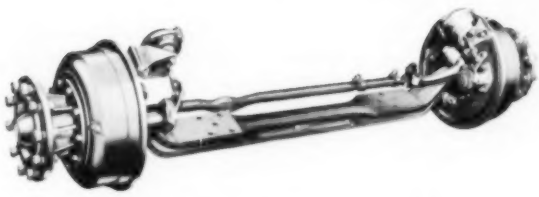
Straight-line drive with large diameter tubular propeller shafts gives smooth power flow.

Resilient rubber cushion encases center bearing, absorbs up to 80% of propeller shaft vibration.

Wide-span rear and auxiliary springs provide sturdy, balanced support and smooth ride.

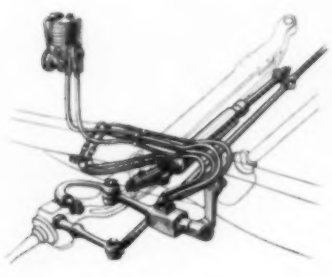
Single-Speed rear axle with one-piece banjo housing, standard; electric-shift, Two-Speed planetary type available.

chassis construction



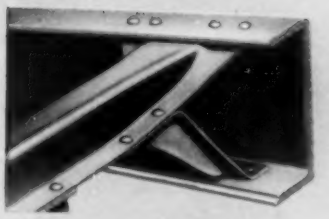
New Front Axles with modified I-beam construction, reinforced at stress points for extra durability. Available in 7000-, 9000-, 11000- and 15000-lb. capacities.

Roll-Action Steering with worm-and-roller type steering gear reduces friction, makes steering easier. Needle-bearing roller provides rolling rather than sliding action.

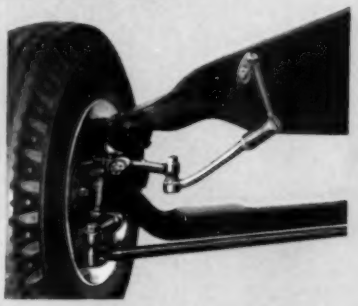


Master-Guide Power Steering is available on all F- and C-Series Extra Heavy Duty models . . . cuts steering effort as much as 75%.

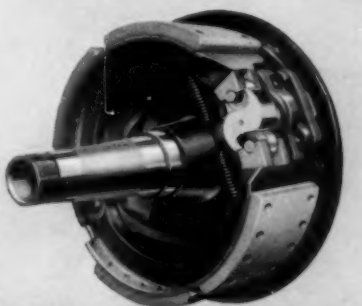
New Electric Fuel Pump mounted in fuel tank. Big capacity, submerged-type fuel pump delivers only liquid fuel—no vapor—under pressure from tank to carburetor. Not dependent on engine rpm's . . . provides ample fuel at any vehicle speed.



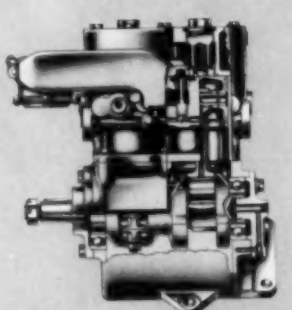
Double-Channel Frame Rails are engineered for extra strength and are highly resistant to twist and weave. Side rails have full channel reinforcement from front to rear springs.



Steering Linkage, solid Direct-Acting drag link, U-type steering arm and adjustable tie rod give excellent steering control and maneuverability.

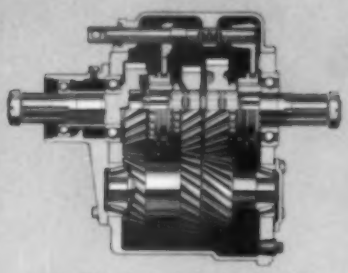


Full-Air Brakes are standard on F- and C-1000 and 1100 models, available 850 and 950. Compressor, two reservoir tanks, buzzer low-pressure indicator and air-operated windshield wipers included.

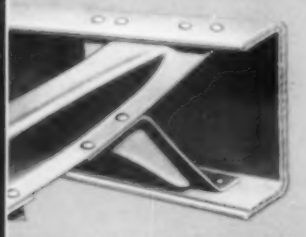


Big 12-cubic foot Air Compressor is available in place of standard 7¼-cu. ft. with full-air brakes on F- and C-950 thru 1100. Large 12-cubic foot per minute capacity provides extra safety factor.

FORD Tandem Chassis for

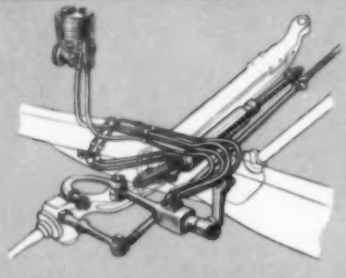


Two all-helical, 3-Speed Auxiliary constant mesh transmissions are available (except 144" wb. T-850) for greater operating flexibility.



Double-Channel frame side rails for extra strength, lower weight. Channel-reinforced from front spring to end of frame.

Roadranger Transmission with 8 closely spaced forward speeds and preselect range shifting is optional for all models. Not offered with auxiliary transmission.



Master-Guide Power Steering standard . . . always operative, cuts steering effort up to 75%.

Large capacity flat-tube radiator with cylindrical top tank gives high cooling efficiency. Durable U-type support.

High-capacity, wide-tread, set-back front axle provides shorter turning, more stability, improved weight distribution.

Durable tie-rod ends are spring-loaded, ball-socket type with dust shields, for automatic wear take-up.

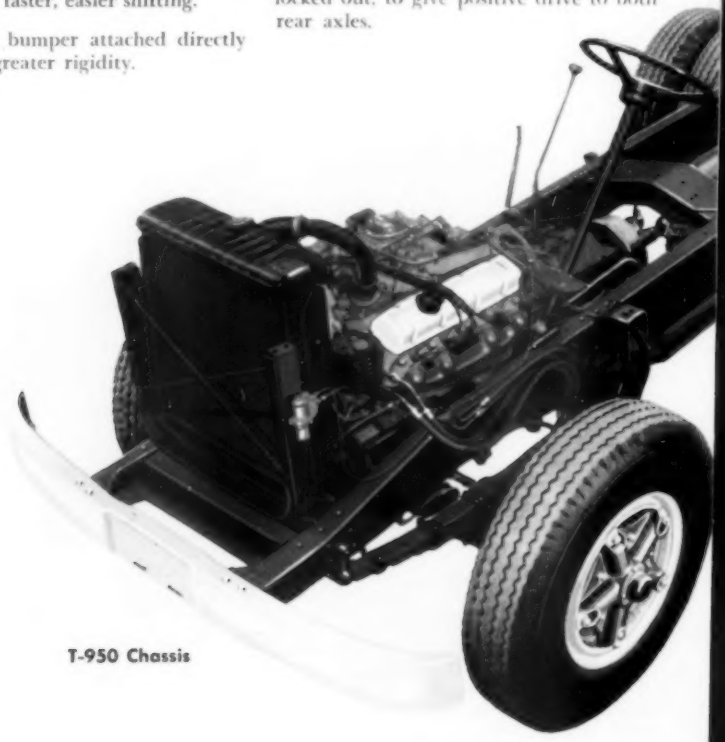
Synchro-Silent 5-Speed direct transmission is standard for faster, easier shifting.

Channel front bumper attached directly to frame, for greater rigidity.

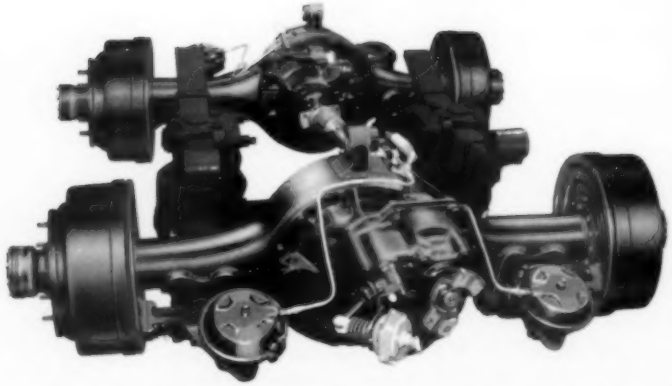
Tubular propeller shafts, large diameter, non-whipping. Long-lived needle-bearing joints. Rubber-encased drive line center bearing for longer life.

Torque arms absorb starting and stopping thrusts. Arms are rubber bushed at each end, and need no lubrication.

Power divider, provided with 3rd differential, equalizes the driving power between axles, eliminates axle fight for longer gear and tire life. The third differential may be locked out, to give positive drive to both rear axles.



T-950 Chassis



38D—38,000-lb. Tandem Axle (Std. T-950). Full-floating straight through drive axle with Single-Speed power divider on forward rear axle. Available with a choice of single reduction and planetary double reduction ratios. Equipped with full-air brakes.

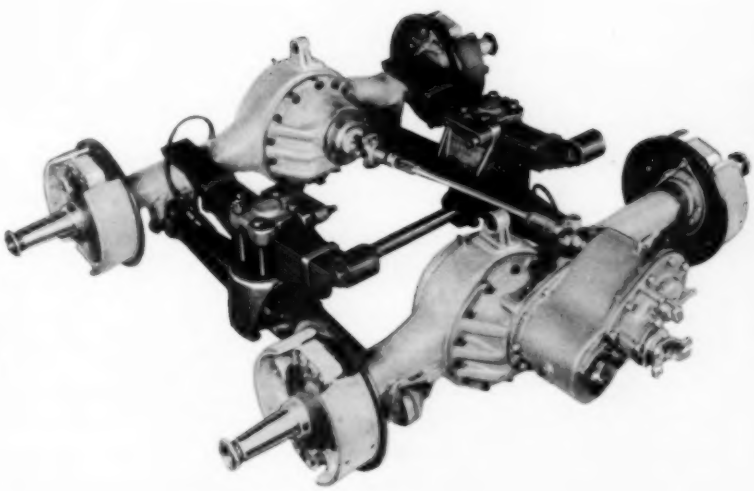
extra payloads

More flotation is provided by eight rear tires . . . keeps truck from bogging down in mud, sand and other soft footing where single-rear-axle trucks would normally flounder. Walking-beam action levels bumps by 50%, minimizes "bounce."

28M—28,000-lb. Tandem Axle (Opt. T-850). Full-floating, single reduction type with a Single-Speed power divider mounted on forward rear axle. Available with hydraulic or full-air brakes. Hypoid ring gear and pinion gear sets.

Two equalizing beams provide true axle alignment, distribute weight between axles. Rubber bushings do away with the need for lubrication.

Husky, short-coupled springs minimize side-sway, absorb road shocks, give smooth, level ride.



34M—34,000-lb. Tandem Axle (Std. T-850). Full-floating, single reduction type with a Single-Speed power divider mounted on forward rear axle. Available with hydraulic or full-air brakes. Spiral bevel ring gear and pinion gear sets.

Differential lockout control located on the instrument panel permits driver to lock out differential action giving each axle the same positive traction as if separately driven.

F-SERIES POWER TRAIN SELECTIONS

Engine—Transmission—Axle Ratio (to 1) Combinations

Transmission	F-850 with 401 SD V-8 Engine		F-950 with 401 SD V-8 Engine	
	18,000-lb. axle	18,000-lb. 2-Speed axle	21,000-lb. axle	21,000-lb. 2-Speed axle
4652	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
4756C	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6352	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
6852G	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6453A	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
R-46	6.50	—	6.50	—

Transmission	F-1000 with 477 SD V-8		F-1000 with 477 SD V-8 F-1100 with 534 SD V-8		F-1100 with 534 SD V-8	
	21,000-lb. axle	21,000-lb. 2-Speed axle	22,000-lb. axle	22,000-lb. 2-Speed axle	29,000-lb. axle	29,000-lb. 2-Speed axle
6352	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	7.03	6.42/8.38 or 7.09/9.07
6852G	—	6.50/8.87	—	6.14/8.36 or 6.71/9.13†	—	—
6453A	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	—	—
R-46	6.50	—	6.17 or 6.67	—	—	—

*Not recommended for tractor service.

†Not recommended for tractor service on F-1100 Series.

F-850 Specifications GVW 25,000 lb. • GCW 50,000 lb.

AXLE, FRONT
Standard Axle Capacity—lb. 7,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs. Requires air brakes, power steering and cast spoke or 10-hole disc wheels.

AXLE, REAR
Capacity—lb. 18,000
Standard—Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios 6.50 or 7.17 to 1
Optional—Type Two-Speed Planet—Full-Floating
Ratios (to 1) 6.50/8.87 or 7.17/9.77*
*7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2¾—0.25
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 5—0.50
Total Area (Lining)—sq. in. 488.6
Booster (Effective Diaphragm Dia.)—in. 10¾
Optional—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2½—0.312
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 579.3
Compressor 7¼ cu. ft. per min.
Air Reservoir Tanks Two—830-cu. in. Cap'y each

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmision on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 10½ x 3—97.7
Optional—Type (with 6000 Series and R-46 Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front and Rear
Max. Section (Depth x Flange x Thick.)—in. 9.5 x 3.0 x 0.25
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.0 x 2.56 x 0.15
Section Modulus 14.93
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side
(Cylindrical not avail. on 132" wb.; Step Tanks require Air Brakes)

SPRINGS

	Front	*Rear*		
		Main	*Auxiliary*	
Semi-Elliptic, Ford Alloy Steel				
Length x Width—in.	52 x 3	56 x 3	37.5 x 3	
Number of Leaves	7	10	7	
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	2500 lb.	7800 lb.	(combined)	
Optional Spring Capacity	3000 lb.	8700 lb.	(combined)	

STEERING
Standard—Type Worm and Dual Row Needle Bearing Roller
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—20.5 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.2	49.5	52.8	58.0	62.7

Optional—Type Master-Guide Power Steering

TRANSMISSION
Standard Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6453A 5-Speed Synchro-Silent Overdrive
Optional 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions Ratios (to 1):	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Four—Cast Spoke
Rims—Number—Size Seven—22.5 x 6.75
Tires—Number—Size Six—10-22.5 10 PR

F-950 Specifications GVW 29,000 lb. • GCW 55,000 lb.

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs. Requires air brakes, power steering.

AXLE, REAR
Capacity—lb. 21,000
Standard—Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios 6.50 or 7.17 to 1
Optional Type Two-Speed Planet—Full-Floating
Ratios (to 1) 6.50/8.87 or 7.17/9.77*
*7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2¾—0.25
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 6—0.50
Total Area (Lining)—sq. in. 556.2
Booster (Effective Diaphragm Dia.)—in. 9½
Optional—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16¾ x 3½—0.44
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 650.0
Compressor 7¼ cu. ft. per min.
Air Reservoir Tanks Two—1,150-cu. in. Cap'y each
Optional Compressor 12 cu. ft. per min.

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmision on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 10½ x 3—97.7
Optional—Type (with 6000 Series and R-46 Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front and Rear
Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.28
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.03 x 0.25
Section Modulus 21.75
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side
(Cylindrical not avail. on 132" wb.; Step Tanks require Air Brakes)

SPRINGS

	Front	*Rear*		
		Main	*Auxiliary*	
Semi-Elliptic, Ford Alloy Steel				
Length x Width—in.	52 x 3	56 x 3	37.5 x 3	
Number of Leaves	7	10	7	
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	3000 lb.	9250 lb.	(combined)	
Optional Spring Capacity	4000 lb.	10000 lb.	(combined)	

STEERING
Standard—Type Worm and Dual Row Needle Bearing Roller
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

Optional—Type Master-Guide Power Steering

TRANSMISSION
Standard Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6453A 5-Speed Synchro-Silent Overdrive
Optional 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions Ratios (to 1):	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger	(9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)					

Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Four—Cast Spoke
Rims—Number—Size Seven—22.5 x 7.5
Tires—Number—Size Six—11-22.5 12 PR

F-1000 Specifications

GVW 30,000 lb. • GCW 55,000 lb. (Opt. GCW 65,000 lb.*)

**Requires 22,000-lb. rear axle*

AXLE, FRONT
- Standard Axle Capacity—lb. 9,000
- Optional Axle Capacity—lb. 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. 21,000
- Standard—Type: Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios: 6.50 or 7.17 to 1
- Optional—Type: Two-Speed Planet—Full-Floating
  - Ratios (to 1): 6.50/8.87
- Optional Capacity—lb. 22,000
  - Type: Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios: 6.17 or 6.67 to 1
  - Type: Two-Speed Planet—Full-Floating
  - Ratios (to 1): 6.14/8.36 or 6.71/9.13

BRAKES, SERVICE
- Standard—Type: Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.75
- Total Area (Lining)—sq. in. 650.0
- Compressor: 7¼ cu. ft. per min.
- Air Reservoir Tanks: Two—1,150-cu. in. Cap'y each
- Optional Brakes (w./9,000- or 11,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. 718.2
- Optional Brakes (w./15,000-lb. Front and 21,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. 664.6
- Optional Brakes (w./15,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. 732.8
- Optional Compressor: 12 cu. ft. per min.

BRAKE, HAND
- Type: Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
- Type: Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. 378

COOLING SYSTEM
- Type—Capacity—qt. Three-Stage—46
- Thermostats: Two, in Intake Manifold
- Fan, Diameter—in. 21—5-Blade

DRIVE LINE
- Type: Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number: Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type: Three, Needle Roller Bearing
- Center Bearing: Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery: 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator: 50 Amp., 750 Watts
- Headlights: Dual Sealed-Beam, Foot-Switch Beam Control
- Starter: High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard: 260-hp 477 Super Duty V-8

FRAME
- Side Rails—Type: Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.28
- Reinforcement: Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.03 x 0.25
- Section Modulus: 21.75
- Cross Members—Type: Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon: Frame-Mounted, Left Side
- Optional: 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.)

SPRINGS

	Front	Rear		
		Main	Auxiliary	
Semi-Elliptic, Ford Alloy Steel				
Length x Width—in.	52 x 3	56 x 3	37.5 x 3	
Number of Leaves	7	10	9	
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	3000 lb.	9650 lb. (combined)		
Optional Spring Capacity	4000 lb.	10400 lb. (combined)		

STEERING
- Standard—Type: Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio: 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

- Optional—Type: Master-Guide Power Steering

TRANSMISSION
- Standard: Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional: 8-Speed R-46 Roadranger (6.17, 6.50 or 6.67 axle ratio required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening: SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type: Four—Cast Spoke
- Rims—Number—Size: Seven—22.5 x 7.5
- Tires—Number—Size: Six—11-22.5 12 PR

F-1100 Specifications

GVW 30,000 lb. • GCW 65,000 lb. (Opt. GVW 36,000 lb.*)

**Requires 11,000-lb. front axle, 29,000-lb. rear axle, HD rear main springs and special frame*

AXLE, FRONT
- Standard Axle Capacity—lb. 9,000
- Optional Axle Capacity—lb. 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. 22,000
- Standard—Type: Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios: 6.17 or 6.67 to 1
- Optional—Type: Two-Speed Planet—Full-Floating
  - Ratios (to 1): 6.14/8.36 or 6.71/9.13*
- Optional Capacity—lb. 29,000**
  - Type: Double Reduction—Hypoid, Helical—Full-Floating
  - Axle Ratios: 7.03 to 1
  - Type: Two-Speed Double Reduction—Full-Floating
  - Ratios (to 1): 6.42/8.38 or 7.09/9.07

*6.71/9.13 ratio not recommended for tractor service.
**With 6352 Transmission only. Not available with 132" wb.

BRAKES, SERVICE
- Standard—Type: Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 3½—0.312
- Rear Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 7—0.75
- Total Area (Lining)—sq. in. 718.2
- Compressor: 7¼ cu. ft. per min.
- Air Reservoir Tanks: Two—1,150-cu. in. Cap'y each
- Optional Brakes (w./15,000-lb. Front and 22,000- or 29-000-lb. Rear Axles) 732.8
- Total Area (Lining)—sq. in.
- Optional Compressor: 12 cu. ft. per min.

BRAKE, HAND
- Type: Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Diameter x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
- Type: Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. 378

COOLING SYSTEM
- Type—Capacity—qt. Three-Stage—47
- Thermostats: Two, in Intake Manifold
- Fan, Diameter—in. 23—5-Blade

DRIVE LINE
- Type: Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number: Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type: Three, Needle Roller Bearing
- Center Bearing: Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery: 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator: 50 Amp., 750 Watts
- Headlights: Dual Sealed-Beam, Foot-Switch Beam Control
- Starter: High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard: 277-hp 534 Super Duty V-8

FRAME
- Side Rails—Type: Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.28
- Reinforcement: Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.03 x 0.25
- Section Modulus: 21.75
- Cross Members—Type: Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon: Frame-Mounted, Left Side
- Optional: 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side (Cylindrical not avail. on 132" wb.)

SPRINGS

	Front	Rear	
		Main	Auxiliary
Semi-Elliptic, Ford Alloy Steel			
Length x Width—in.	52 x 3	56 x 3	37.5 x 3
Number of Leaves	7	10	9
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	3000 lb.	9650 lb. (combined)	
Optional Spring Capacity	4000 lb.	10400 lb. (combined)	

STEERING
- Standard—Type: Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio: 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	132"	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	46.1	49.4	52.7	57.9	62.6

- Optional—Type: Master-Guide Power Steering

TRANSMISSION
- Standard: Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional: Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional: 8-Speed R-46 Roadranger (6.17 or 6.67 axle ratio required)

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening: SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type: Four—Cast Spoke
- Rims—Number—Size: Seven—22.5 x 7.5
- Tires—Number—Size: Six—11-22.5 12 PR

C-SERIES POWER TRAIN SELECTIONS
Engine—Transmission—Axle Ratio (to 1) Combinations

	C-850 with 401 SD V-8 Engine		C-950 with 401 SD V-8 Engine	
Transmission	**18,000-lb. axle**	**18,000-lb. 2-Speed axle**	**21,000-lb. axle**	**21,000-lb. 2-Speed axle**
4652	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
4756C	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6352	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
6852G	—	6.50/8.87 or 7.17/9.77*	—	6.50/8.87 or 7.17/9.77*
6453A	6.50 or 7.17	6.50/8.87 or 7.17/9.77*	6.50 or 7.17	6.50/8.87 or 7.17/9.77*
R-46	6.50	—	6.50	—

	C-1000 with 477 SD V-8		C-1000 with 477 SD V-8 C-1100 with 534 SD V-8		C-1100 with 534 SD V-8	
Transmission	**21,000-lb. axle**	**21,000-lb. 2-Speed axle**	**22,000-lb. axle**	**22,000-lb. 2-Speed axle**	**29,000-lb. axle**	**29,000-lb. 2-Speed axle**
6352	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	7.03	6.42/8.38 or 7.09/9.07
6852G	—	6.50/8.87	—	6.14/8.36 or 6.71/9.13†	—	—
6453A	6.50 or 7.17	6.50/8.87	6.17 or 6.67	6.14/8.36 or 6.71/9.13†	—	—
R-46	6.50	—	6.17 or 6.67	—	—	—

*Not recommended for tractor service.

†Not recommended for tractor service on C-1100 Series.

C-850 Specifications GVW 26,000 lb. • GCW 50,000 lb.

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs. Requires air brakes, power steering and cast spoke or 10-hole disc wheels.

AXLE, REAR
Capacity—lb. 18,000
Standard—Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios 6.50 or 7.17 to 1
Optional—Type Two-Speed Planet—Full-Floating
Ratios (to 1) 6.50/8.87 or 7.17/9.77*
*7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2¼—0.25
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 5—0.50
Total Area (Lining)—sq. in. 488.6
Booster (Effective Diaphragm Dia.)—in. 10¼
Optional—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2½—0.312
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 579.3
Compressor 7¼ cu. ft. per. min.
Air Reservoir Tanks Two—830-cu. in. Cap'y each

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmision on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 10½ x 3—97.7
Optional—Type (with 6000 Series and R-46 Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—51
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number, Type (99" & 111" wb.) One, Tubular, Forged-Steel Ends
(135" & 153" wb.) Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type (99" & 111" wb.) Two, Needle Roller Bearing
(135" & 153" wb.) Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front and Rear
Max. Section (Depth x Flange x Thick.)—in. 9.5 x 3.0 x 0.25
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.0 x 2.56 x 0.15
Section Modulus 14.93
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
Standard—Type Double-Acting, Telescopic

SPRINGS

	Front	Rear	
Semi-Elliptic, Ford Alloy Steel		Main	Auxiliary
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	4000 lb.	7800 lb.	(combined)
Optional Spring Capacity		8700 lb.	(combined)

STEERING
Standard—Type Worm and Dual Row Needle Bearing Roller
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.9	41.1	47.7	52.6

Optional—Type Master-Guide Power Steering

TRANSMISSION
Standard Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6453A 5-Speed Synchro-Silent Overdrive
Optional 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions Ratios (to 1):	First	Second	Third	Fourth	Fifth	Reverse
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev.11.01)						

Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Four—Cast Spoke
Rims—Number—Size Seven—22.5 x 6.75
Tires—Number—Size Six—10-22.5 10 PR

C-950 Specifications GVW 30,000 lb. • GCW 55,000 lb.

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs. Requires air brakes, power steering.
Optional Axle Capacity—lb. 15,000
Includes 6,800-lb. front springs. Requires air brakes, power steering.

AXLE, REAR
Capacity—lb. 21,000
Standard—Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios 6.50 or 7.17 to 1
Optional—Type Two-Speed Planet—Full-Floating
Ratios (to 1) 6.50/8.87 or 7.17/9.77*
*7.17/9.77 ratio not recommended for tractor service.

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front: Double Anchor. Rear: Two-Cylinder, Self-Energizing
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 2¼—0.25
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16 x 6—0.50
Total Area (Lining)—sq. in. 556.2
Booster (Effective Piston Dia.)—in. 9½
Optional—Type (w/9,000- or 11,000-lb. front axles) Full-Air, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 16¼ x 3½—0.44
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 650.0
Compressor 7¼ cu. ft. per min.
Air Reservoir Tanks Two—1,150-cu. in. Cap'y each
Optional Compressor 12 cu. ft. per min.
Optional Full Air Brakes (w/15,000 front axle)
Front Brake (Drum Dia. x Lining Width—Thickness)—in. 17¼ x 3½—0.44
Rear Brake (Drum Dia. x Lining Width—Thickness)—in. 16½ x 6—0.50
Total Area (Lining)—sq. in. 664.6

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmission on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 10½ x 3—97.7
Optional—Type (with 6000 Series and R-46 Transmisions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. In.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—51
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number, Type (99" & 111" wb.) One, Tubular, Forged-Steel Ends
(135" & 153" wb.) Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type (99" & 111" wb.) Two, Needle Roller Bearing
(135" & 153" wb.) Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front and Rear
Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.28
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.03 x 0.25
Section Modulus 21.75
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
Standard—Type Double-Acting, Telescopic

SPRINGS

	Front	Rear	
Semi-Elliptic, Ford Alloy Steel		Main	Auxiliary
Length x Width—in.	57 x 3	56 x 3	37.5 x 3
Number of Leaves	9	10	7
Capacity at Spg. Pad (Norm. Defl.)—Per Spring	4000 lb.	9250 lb.	(combined)
Optional Spring Capacity		10000 lb.	(combined)

STEERING
Standard—Type Worm and Dual Row Needle Bearing Roller
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.9	41.2	47.8	52.7

Optional—Type Master-Guide Power Steering

TRANSMISSION
Standard Spicer 4652 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 4756C 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
Optional Spicer 6453A 5-Speed Synchro-Silent Overdrive
Optional 8-Speed R-46 Roadranger (6.50 axle ratio and air brakes required)

Gear Positions Ratios (to 1):	First	Second	Third	Fourth	Fifth	Reverse
4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
4756C 5-Speed Direct	6.50	3.52*	1.93*	1.17*	1.00*	6.88
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Four—Cast Spoke
Rims—Number—Size Seven—22.5 x 7.5
Tires—Number—Size Six—11-22.5 12 PR

C-1000 Specifications

GVW 31,000 lb. • GCW 55,000 lb. (Opt. GCW 65,000 lb.*)

**Requires 22,000-lb. rear axle*

AXLE, FRONT
- Standard Axle Capacity—lb. ... 9,000
- Optional Axle Capacity—lb. ... 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. ... 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. ... 21,000
- Standard—Type ... Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios ... 6.50 or 7.17 to 1
- Optional—Type ... Two-Speed Planet—Full-Floating
  - Ratios (to 1) ... 6.50/8.87
- Optional Capacity—lb. ... 22,000
  - Type ... Single Reduction—Spiral Bevel—Full-Floating
    - Axle Ratios ... 6.17 or 6.67 to 1
  - Type ... Two-Speed Planet—Full-Floating
    - Ratios (to 1) ... 6.14/8.36 or 6.71/9.13

BRAKES, SERVICE
- Standard—Type ... Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thickness)—in. ... 16½ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thickness)—in. ... 16½ x 6—0.75
- Total Area (Lining)—sq. in. ... 650.0
- Compressor ... 7¾ cu. ft. per min.
- Air Reservoir Tanks ... Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/9,000- or 11,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 718.2
- Optional Brakes (w/15,000-lb. Front and 21,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 664.6
- Optional Brakes (w/15,000-lb. Front and 22,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 732.8
- Optional Compressor ... 12 cu. ft. per min.

BRAKE, HAND
- Type ... Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) ... 12 x 4—111.6

CLUTCH
- Type ... Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. ... 378

COOLING SYSTEM
- Type—Capacity—qt. ... Three-Stage—51
- Thermostats ... Two, in Intake Manifold
- Fan, Diameter—in. ... 21—5-Blade

DRIVE LINE
- Type ... Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type ... (99" & 111" wb.) One, Tubular, Forged-Steel Ends (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type ... (99" & 111" wb.) Two, Needle Roller Bearing (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing ... Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery ... 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator ... 50 Amp., 750 Watts
- Headlights ... Dual Sealed-Beam, Foot-Switch Beam Control
- Starter ... High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard ... 260-hp 477 Super Duty V-8

FRAME
- Side Rails—Type ... Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.75 x 3.50 x 0.28
- Reinforcement ... Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.20 x 3.03 x 0.25
- Section Modulus ... 21.75
- Cross Members—Type ... Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon ... Frame-Mounted, Left Side
- Optional ... 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type ... Double-Acting, Telescopic

SPRINGS

	Front	*Rear*		
Semi-Elliptic, Ford Alloy Steel		*Main*	*Auxiliary*	
Length x Width—in.	57 x 3	56 x 3	37.5 x 3	
Number of Leaves	9	10	9	
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	9650 lb.	(combined)	
Optional Spring Capacity		10400 lb.	(combined)	

STEERING
- Standard—Type ... Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio ... 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.7	41.0	47.6	52.5

- Optional—Type ... Master-Guide Power Steering

TRANSMISSION
- Standard ... Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional ... 8-Speed R-46 Roadranger (6.17, 6.50 or 6.67 axle ratio required)

Gear Positions	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening ... SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type ... Four—Cast Spoke
- Rims—Number—Size ... Seven—22.5 x 7.5
- Tires—Number—Size ... Six—11-22.5 12 PR

C-1100 Specifications

GVW 31,000 lb. • GCW 65,000 lb. (Opt. GVW 36,000 lb.*)

**Requires 11,000-lb. front axle, 29,000-lb. rear axle, HD rear main springs and special frame*

AXLE, FRONT
- Standard Axle Capacity—lb. ... 9,000
- Optional Axle Capacity—lb. ... 11,000
  - Includes 5,000-lb. front springs. Requires power steering.
- Optional Axle Capacity—lb. ... 15,000
  - Includes 6,800-lb. front springs. Requires power steering.

AXLE, REAR
- Capacity—lb. ... 22,000
- Standard—Type ... Single Reduction—Spiral Bevel—Full-Floating
  - Axle Ratios ... 6.17 or 6.67 to 1
- Optional—Type ... Two-Speed Planet—Full-Floating
  - Ratios (to 1) ... 6.14/8.36 or 6.71/9.13*
- Optional Capacity—lb. ... 29,000**
  - Type ... Double Reduction—Hypoid, Helical—Full-Floating
    - Axle Ratios ... 7.03 to 1
  - Type ... Two-Speed Double Reduction—Full-Floating
    - Ratios (to 1) ... 6.42/8.38 or 7.09/9.07

*Not recommended for tractor service.
**With 6352 transmission only. Not available with 99" wb.

BRAKES, SERVICE
- Standard—Type ... Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters, Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
- Front Brake (Drum Dia. x Lining Width—Thick.)—in. ... 16½ x 3½—0.44
- Rear Brake (Drum Dia. x Lining Width—Thick.)—in. ... 16½ x 7—0.75
- Total Area (Lining)—sq. in. ... 718.2
- Compressor ... 7¾ cu. ft. per min
- Air Reservoir Tanks ... Two—1,150-cu. in. Cap'y each
- Optional Brakes (w/15,000-lb. Front and 22,000-lb. or 29,000-lb. Rear Axles)
  - Total Area (Lining)—sq. in. ... 732.8
- Optional Compressor ... 12 cu. ft. per min.

BRAKE, HAND
- Type ... Internal Shoe at Rear of Transmission on Drive Line
- Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) ... 12 x 4—111.6

CLUTCH
- Type ... Hydraulically Operated, 13-in., Constant Pressure Two-Plate
- Total Frictional Area—sq. in. ... 378

COOLING SYSTEM
- Type—Capacity—qt. ... Three-Stage—52
- Thermostats ... Two, in Intake Manifold
- Fan, Diameter—in. ... 23—5-Blade

DRIVE LINE
- Type ... Hotchkiss, Straight-Line Drive
- Propeller Shafts—Number, Type ... (99" & 111" wb.) One, Tubular, Forged-Steel Ends (135" & 153" wb.) Two, Tubular, Forged-Steel Ends
- Universal Joints—Number, Type ... (99" & 111" wb.) Two, Needle Roller Bearing (135" & 153" wb.) Three, Needle Roller Bearing
- Center Bearing ... Rubber-Encased Ball Type

ELECTRICAL SYSTEM
- Battery ... 12-Volt, 78-Plate, 70 Amp-Hr
- Alternator ... 50 Amp., 750 Watts
- Headlights ... Dual Sealed-Beam, Foot-Switch Beam Control
- Starter ... High Torque, Ignition Key Starter Control
- Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
- Standard ... 277-hp Super Duty V-8

FRAME
- Side Rails—Type ... Parallel, Channel Section—Tapered Front and Rear
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.75 x 3.50 x 0.28
- Reinforcement ... Channel, Inside Side Rail
  - Max. Section (Depth x Flange x Thick.)—in. ... 9.20 x 3.03 x 0.25
- Section Modulus ... 21.75
- Cross Members—Type ... Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
- 18-gallon ... Frame-Mounted, Left Side
- Optional ... 125-gal. Saddle Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side

SHOCK ABSORBERS (Front)
- Standard—Type ... Double-Acting, Telescopic

SPRINGS

	Front	*Rear*		
Semi-Elliptic, Ford Alloy Steel		*Main*	*Auxiliary*	
Length x Width—in.	57 x 3	56 x 3	37.5 x 3	
Number of Leaves	9	10	9	
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	9650 lb.	(combined)	
Optional Spring Capacity		10400 lb.	(combined)	

STEERING
- Standard—Type ... Worm and Dual Row Needle Bearing Roller
- Wheel—Over-all Ratio ... 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	99"	111"	135"	153"
Turning Circle Dia., Right or Left—ft.	37.8	41.1	47.8	52.8

- Optional—Type ... Master-Guide Power Steering

TRANSMISSION
- Standard ... Spicer 6352 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6852G 5-Speed Synchro-Silent Direct-In-Fifth
- Optional ... Spicer 6453A 5-Speed Synchro-Silent Overdrive
- Optional ... 8-Speed R-46 Roadranger (6.17 or 6.67 axle ratio required)

Gear Positions	*First*	*Second*	*Third*	*Fourth*	*Fifth*	*Reverse*
Ratios (to 1):						
6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33
6852G 5-Speed Direct	6.71	3.52*	1.97*	1.17*	1.00*	6.72
6453A 5-Speed Overdrive	6.07	3.40*	1.79*	1.00*	0.83*	6.09
R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01)						

- Power Take-Off Opening ... SAE 6-Bolt, On Both Sides

*Synchronized Speeds.

WHEELS AND TIRES (Standard)
- Wheels—Number—Type ... Four—Cast Spoke
- Rims—Number—Size ... Seven—22.5 x 7.5
- Tires—Number—Size ... Six—11-22.5 12 PR

T-SERIES POWER TRAIN SELECTIONS
Engine—Transmission—Axle Ratio (to 1) Combinations

T-850

Transmission	401 SD V-8		477 SD V-8	534 SD V-8
	28,000-lb. axle	34,000-lb. axle	34,000-lb. axle	34,000-lb. axle
4652 w/o Aux.	7.07 or 7.79	7.80 or 8.60	—	—
4652 w/7231B	7.07 or 7.79	7.80 or 8.60	—	—
4652 w/7231D	7.07 or 7.79	7.80 or 8.60	—	—
6352 w/o Aux.	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	5.85, 6.69 or 7.80
6352 w/7231B	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	5.85, 6.69 or 7.80
6352 w/7231D	7.07 or 7.79	7.80 or 8.60	6.69 or 7.80	—
R-46	7.07 or 7.79	6.69 or 7.80	5.85, 6.69 or 7.80	5.85, 6.69 or 7.80

T-950

Transmission	401 SD V-8	477 SD V-8	534 SD V-8
	38,000-lb. axle	38,000-lb. axle	38,000-lb. axle
4652 w/o Aux.	7.60 or 8.38	—	—
4652 w/7231B	7.60 or 8.38	—	—
4652 w/7231D	7.60 or 8.38	—	—
6352 w/o Aux.	7.60 or 8.38	6.50, 7.60 or 8.38	5.57, 6.50, 7.60 or 8.38
6352 w/7231B	7.60 or 8.38	6.50, 7.60 or 8.38	5.57, 6.50, 7.60 or 8.38
6352 w/7231D	7.60 or 8.38	6.50, 7.60 or 8.38	6.50, 7.60 or 8.38
R-46	7.60	6.50 or 7.60	5.57 or 6.50

T-850 Specifications

GVW 43,000 lb. • GCW 70,000 lb. (Opt. GVW 37,000* or 45,000† lb.)—(Opt. GCW 55,000 lb.*)

*Requires 28,000-lb. rear axle, 9,000-lb. front axle and 401 SD V-8
†Requires 34,000-lb. rear axle, 11,000-lb., or 15,000-lb. front axle, air brakes and maximum size wheels and tires

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000*
Includes 5,000-lb. front springs.
Optional Axle Capacity—lb. 15,000*
Includes 6,800-lb. front springs. *w/45,000-lb. GVW package only.

AXLE, REAR
Capacity—lb. 34,000
Type Single Reduction—Spiral Bevel—Full-Floating
Axle Ratios (w/401 V-8) 6.69,* 7.80 or 8.60 to 1
Optional Ratios (w/477 V-8) 5.85,* 6.69** or 7.80 to 1
(w/534 V-8) 5.85,** 6.69** or 7.80 to 1
*Available only with R-46 transmission and air brakes.
**Available only with air brakes.
Optional Capacity—lb. 28,000
Axle Ratios (w/401 V-8) 7.07 or 7.79 to 1
(includes 9-22.5 10 PR tires on 6.75 rims)

BRAKES, SERVICE
Standard—Type Vacuum-Power Operated, Hydraulic, Two-Shoe
Front Brake (Drum Dia. x Lining Width—Thick.)—in. 16 x 2½—0.25
Rear Brake (Drum Dia. x Lining Width—Thick.)—in. 16 x 5—0.50
Total Area (Lining)—sq. in. 807.6
Booster (Effective Dia.)—in. 9.5
Optional Vacuum-Hydraulic Brakes (w/28,000-lb. Rear Axle)
Total Area (Lining)—sq. in. 765.6
Optional—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters: Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Compressor 7¼ cu. ft. per min.
Air Reserve Tanks Three—830-cu. in. Cap'y each:
Optional Full-Air Brakes (w/9,000-lb. front and 28,000-lb. rear)
Total Area (Lining)—sq. in. 767.7
Optional—Full-Air Brakes (w/9,000- or 11,000-lb. front & 34,000-lb. rear)
Total Area (Lining)—sq. in. 904.7
Optional Full-Air Brakes (w/15,000-lb. front and 34,000-lb. rear axles)
Total Area (Lining)—sq. in. 1006.8
Optional Compressor 12 cu. ft. per min.

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmission on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 11½ x 4—142.7
Optional Type (with R-46, 6,000 and 7,000 Series Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46 (47 with 534 SD V-8)
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21 (23 with 534 SD V-8)—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8
Optional 260-hp 477 Super Duty V-8†
Optional 277-hp 534 Super Duty V-8†
†Optional main transmission required.

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front, Full-Depth Rear
Max. Section (Depth x Flange x Thick.)—in. 9.75 x 3.50 x 0.375
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.00 x 3.125 x 0.15
Section Modulus 22.06
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks (except 144" wb.); 100-gal. Step Tanks, with air brakes only; 60-gal. Cylindrical Tank for Right and/or Left Side. (Cylindrical not avail. on 144" and 156" wb.)

SPRINGS

	Front	Rear
Semi-Elliptic, Ford Alloy Steel		
Length x Width—in.	52 x 3	34 x 4
Number of Leaves	8	12
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	15500 lb.

STEERING
Standard—Type Master-Guide Power Steering
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	144"	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	49.4	52.7	58.0	62.6

TRANSMISSION

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
Standard 4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
Optional 6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33

Optional R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01) (Axle ratios required: 5.85, 6.69, 7.80, 7.79 or 7.07. Not available with auxiliary transmission.)
Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

TRANSMISSION, AUXILIARY (except 144" wb.)

Gear Positions	Overdrive	Underdrive	Direct
Ratios (to 1):			
Optional Spicer 7231B 3-Speed	0.86	1.24	1.00
Optional Spicer 7231D* 3-Speed	0.86	2.14	1.00

*Not available with 534 SD V-8.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Six—Cast Spoke
Rims—Number—Size Eleven—22.5 x 6.75
Tires—Number—Size Ten—10-22.5 10 PR

T-950 Specifications

GVW 46,000 lb. • GCW 75,000 lb. (Opt. GVW 48,000* or 51,000† lb.)

*Requires 11,000-lb. front axle
†Requires 15,000-lb. front axle

AXLE, FRONT
Standard Axle Capacity—lb. 9,000
Optional Axle Capacity—lb. 11,000
Includes 5,000-lb. front springs.
Optional Axle Capacity—lb. 15,000
Includes 6,800-lb. front springs.

AXLE, REAR
Capacity—lb. 38,000
Type Single Speed—Spiral Bevel—Full-Floating
Axle Ratios (w/401 V-8) 7.60 or 8.38 to 1
Optional Ratios (w/477 V-8) 6.50, 7.60 or 8.38 to 1
(w/534 V-8) 5.57,* 6.50, 7.60 or 8.38 to 1
*Not used in combination w/7231D auxiliary transmission.

BRAKES, SERVICE
Standard—Type Full-Air, Heavy-Duty Two-Shoe with Slack Adjusters: Air Gauge on Instrument Panel, Air Windshield Wipers and Air Warning Buzzer
Front Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 3½—0.312
Rear Brake (Drum Dia. x Lining Width—Thick.)—in. 16½ x 6—0.75
Total Area (Lining)—sq. in. 1061.8
Compressor 7¼ cu. ft. per min.
Air Reservoir Tanks One—1275-cu. in.; Two—1395-cu. in. Cap'y each
Optional Compressor 12 cu. ft. per min.
Optional Brakes—(w/15,000-lb. Front and 38,000-lb. Rear Axles)
Total Area (Lining)—sq. in. 1076.4

BRAKE, HAND
Standard—Type Drum and Contracting Band at Rear of Transmission on Drive Line
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 11½ x 4—142.7
Optional—Type (with R-46, 6,000 and 7,000 Series Transmissions) Internal Shoe
Size (Drum Dia. x Lining Width, in.—Lining Area, sq. in.) 12 x 4—111.6

CLUTCH
Type Hydraulically Operated, 13-in., Constant Pressure Two-Plate
Total Frictional Area—sq. in. 378

COOLING SYSTEM
Type—Capacity—qt. Three-Stage—46 (47 with 534 SD V-8)
Thermostats Two, in Intake Manifold
Fan, Diameter—in. 21 (23 with 534 SD V-8)—5-Blade

DRIVE LINE
Type Hotchkiss, Straight-Line Drive
Propeller Shafts—Number Two, Tubular, Forged-Steel Ends
Universal Joints—Number, Type Three, Needle Roller Bearing
Center Bearing Rubber-Encased Ball Type

ELECTRICAL SYSTEM
Battery 12-Volt, 78-Plate, 70 Amp-Hr
Alternator 50 Amp., 750 Watts
Headlights Dual Sealed-Beam, Foot-Switch Beam Control
Starter High Torque, Ignition Key Starter Control
Parking Lights; Left Combination Stop and Taillight; Instrument Lights; Ignition Switch with Key Lock; Circuit Breakers; Rectifier

ENGINE
Standard 226-hp 401 Super Duty V-8
Optional 260-hp 477 Super Duty V-8‡
Optional 277-hp 534 Super Duty V-8‡
‡Optional main transmission required.

FRAME
Side Rails—Type Parallel, Channel Section—Tapered Front, Full-Depth Rear
Max. Section (Depth x Flange x Thick.)—in. 9.95 x 3.50 x 0.375
Reinforcement Channel, Inside Side Rail
Max. Section (Depth x Flange x Thick.)—in. 9.20 x 3.125 x 0.25
Section Modulus 25.65
Cross Members—Type Flanged "U" Type with Alligator Jaw or Channel Type

FUEL TANK (All Tanks include Electric Fuel Pumps)
18-gallon Frame-Mounted, Left Side
Optional 125-gal. Saddle Tanks; 100-gal. Step Tanks; 60-gal. Cylindrical Tank for Right and/or Left Side. (Cylindrical not avail. on 156" wb.)

SPRINGS

	Front	Rear
Semi-Elliptic, Ford Alloy Steel		
Length x Width—in.	52 x 3	34 x 4
Number of Leaves	8	12
Capacity at Spg. Pad (Norm. Defl.)—Per Spg.	4000 lb.	15500 lb.

STEERING
Standard—Type Master-Guide Power Steering
Wheel—Over-all Ratio 20-in. Dia., 3-Spoke—24.4 to 1

Wheelbase	156"	175"	192"
Turning Circle Dia., Right or Left—ft.	52.7	57.9	62.6

TRANSMISSION

Gear Positions	First	Second	Third	Fourth	Fifth	Reverse
Ratios (to 1):						
Standard 4652 5-Speed Direct	7.40	4.00*	2.47*	1.46*	1.00*	7.84
Optional 6352 5-Speed Direct	7.31	4.09*	2.41*	1.44*	1.00*	7.33

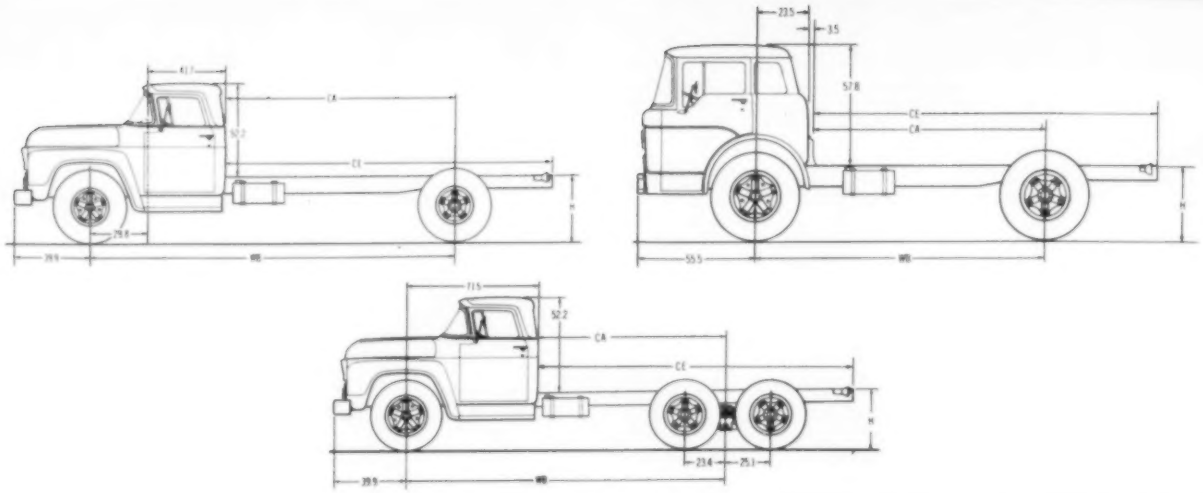
Optional R-46 8-Speed Roadranger (9.78, 6.98, 4.99, 3.68, 2.66, 1.90, 1.36, 1.00, rev. 11.01) (Axle ratios required: 7.60 w/401 V-8, 6.50 or 7.60 w/477 V-8 and 5.57 or 6.50 w/534 V-8. Not available with auxiliary transmission.)
Power Take-Off Opening SAE 6-Bolt, On Both Sides
*Synchronized Speeds.

TRANSMISSION, AUXILIARY

Gear Positions	Overdrive	Underdrive	Direct
Ratios (to 1):			
Optional Spicer 7231B 3-Speed	0.86	1.24	1.00
Optional Spicer 7231D* 3-Speed	0.86	2.14	1.00

*Not available in combination with 534 SD V-8 and 5.57 axle ratio.

WHEELS AND TIRES (Standard)
Wheels—Number—Type Six—Cast Spoke
Rims—Number—Size Eleven—22.5 x 7.5
Tires—Number—Size Ten—11-22.5 12 PR



DIMENSIONS AND CHASSIS WEIGHTS

MODEL	WB (in.)	CA (in.)	CE (in.)	Nom. Body Lengths (ft.)	Curb Weights* (lb.) Front	Rear	Total
					10-22.5 10 PR Tires		
	132	60.5	111.7	7½-9	3995	2930	6925
F-850	144	72.5	123.7	9-11	4010	2950	6960
GVW 25,000 lb.	156	84.5	135.7	10-13	4035	3000	7035
	175	103.5	163.5	13-16	4065	3065	7130
	192	120.5	180.5	15-19	4175	3035	7210
					11-22.5 12 PR Tires		
F-950	132	60.5	111.7	7½-9	4285	3255	7540
GVW 29,000 lb.	144	72.5	123.7	9-11	4320	3285	7605
	156	84.5	135.7	10-13	4365	3335	7700
	175	103.5	163.5	13-16	4420	3390	7810
	192	120.5	180.5	15-19	4460	3425	7885
					11-22.5 12 PR Tires		
F-1000	132	60.5	111.7	7½-9	4340	3530	7870
GVW 30,000 lb.	144	72.5	123.7	9-11	4375	3565	7940
	156	84.5	135.7	10-13	4420	3610	8030
	175	103.5	163.5	13-16	4475	3665	8140
	192	120.5	180.5	15-19	4510	3700	8210
					11-22.5 12 PR Tires		
F-1100	132	60.5	111.7	7½-9	4345	3700	8045
GVW 30,000 lb.	144	72.5	123.7	9-11	4380	3735	8115
OPT. GVW 36,000 lb.	156	84.5	135.7	10-13	4425	3780	8205
	175	103.5	163.5	13-16	4480	3835	8315
	192	120.5	180.5	15-19	4520	3875	8395
					10-22.5 10 PR Tires		
C-850	99	72	123.2	9-11	5030	2335	7365
GVW 26,000 lb.	111	84	135.2	10-13	5040	2355	7395
	135	108	168.0	13-16	5135	2410	7545
	153	126	186.0	16-20	5175	2450	7625
					11-22.5 12 PR Tires		
C-950	99	72	123.2	9-11	5205	2775	7980
GVW 30,000 lb.	111	84	135.2	10-13	5225	2805	8030
	135	108	168.0	13-16	5320	2880	8200
	153	126	186.0	16-20	5375	2935	8310
					11-22.5 12 PR Tires		
C-1000	99	72	123.2	9-11	5465	3025	8490
GVW 31,000 lb.	111	84	135.2	10-13	5495	3050	8545
	135	108	168.0	13-16	5560	3095	8655
	153	126	186.0	16-20	5610	3125	8735
					11-22.5 12 PR Tires		
C-1100	99	72	123.2	9-11	5465	3195	8660
GVW 31,000 lb.	111	84	135.2	10-13	5495	3220	8715
OPT. GVW 36,000 lb.	135	108	168.0	13-16	5560	3265	8825
	153	126	186.0	16-20	5610	3295	8905
					10-22.5 10 PR Tires		
T-850	144	72.5	128.5	10-11	4100	6020	10120
GVW 43,000 lb.	156	84.5	144.5	11-13	4140	6055	10195
OPT. GVW 45,000 lb.	175	103.5	175.5	13-16	4210	6105	10315
OPT. GVW 37,000 lb.	192	120.5	204.5	15-19	4275	6155	10430
					11-22.5 12 PR Tires		
T-950							
GVW 46,000 lb.	156	84.5	144.5	11-13	4670	6735	11405
OPT. GVW 48,000 lb.	175	103.5	175.5	13-16	4795	6860	11655
OPT. GVW 51,000 lb.	192	120.5	204.5	15-19	4840	6905	11745

FRAME HEIGHT AT REAR AXLE

SERIES	TIRE SIZE	H (in.) Empty	Loaded
F-850	10-22.5 10 PR	36.0	33.0
	11-22.5 12 PR	36.6	33.6
F-950	11-22.5 12 PR	36.2	33.7
thru	11-24.5 12 PR	37.2	34.7
F-1100	12-22.5 12 or 14 PR	36.9	34.4
	12-24.5 12 PR	37.9	35.4
C-850	10-22.5 10 PR	35.1	32.9
	11-22.5 12 PR	35.7	33.5
C-950	11-22.5 12 PR	36.1	33.7
thru	11-24.5 12 PR	37.1	34.7
C-1100	12-22.5 12 or 14 PR	36.8	34.4
	12-24.5 12 PR	37.8	35.4
T-850	10-22.5 10 PR	38.7	37.7
	11-22.5 12 PR	39.3	38.3
T-950	11-22.5 12 PR	40.3	39.3
	11-24.5 12 PR	41.3	39.3
	12-22.5 12 or 14 PR	41.0	40.0
	12-24.5 12 PR	42.0	41.0

OPTIONAL EQUIPMENT ADD WEIGHTS

	Front	Rear	Total
Axle, Front—11,000 lb.			
F-850	110	0	110
F-950, F-1000, F-1100, T-850, T-950	90	0	90
C-850, C-950	115	0	115
C-1000	80	0	80
C-1100	105	0	105
Axle, Front—18,000 lb.			
F-1000, F-1100	280	0	280
C-950	250	0	250
C-1000	330	0	330
C-1100	360	0	360
T-850, T-950	380	0	380
Axle, Rear—Single-Speed			
F-C-1000—22,000 lb.	0	90	90
F-C-1100—29,000 lb.	0	225	225
Axle, Rear—Two-Speed			
F-C-850—18,000 lb.	0	125	125
F-C-950, F-C-1000—21,000 lb.	0	25	25
F-C-1000—22,000 lb.	0	150	150
F-C-1100—29,000 lb.	0	325	325
Axle, Rear—Tandem			
T-850—28,000 lb.	0	345†	345†
Brakes, Full Air			
F-850, C-850	95	205	300
F-950, C-950	90	165	255
T-850	120	405	525
Power Steering (F- & C-Series)	100	0	100
Transmission—6000 Series			
F-850, F-950	110	35	145
T-850	65	20	85
T-950	95	30	125
Transmission—Roadranger			
F-850, F-950	195	40	235
F-1000, F-1100	75	15	90
C-850, C-950	185	100	285
C-1000, C-1100	60	25	85
T-850 (over 4000 Series)	195	35	230
T-950 (over 4000 Series)	170	40	210
Tires, Tubeless			
F-C-850 11-22.5 12 PR (7.5)	66	140	206
F-C-950 thru 1100			
11-24.5 12 PR (8.25)	58	134	192
12-22.5 12 PR (8.25)	46	103	149
12-24.5 12 PR (8.25)	76	170	246
12-22.5 14 PR (8.25)	68	147	215
T-850 11-22.5 12 PR (7.5)	66	273	339
T-950 11-24.5 12 PR (8.25)	58	250	308
12-22.5 12 PR (8.25)	46	195	241
12-24.5 12 PR (8.25)	76	322	398
12-22.5 14 PR (8.25)	68	272	340

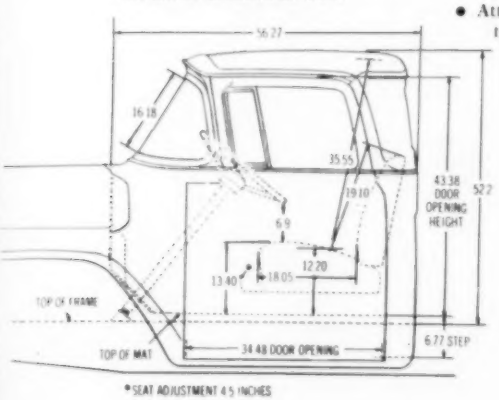
**All weights are estimated. Curb weights include standard cab and equipment, full tank of fuel, oil and lubricants. For Chassis-Cowl deduct 395 lb. "Front," 175 lb. "Rear" and 570 lb. "Total." †Deduct.*

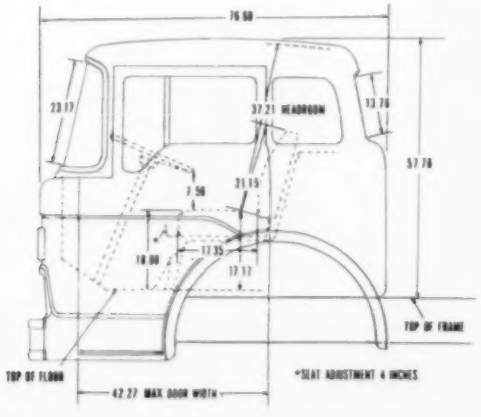
FORD Driverized Cabs

GREATEST CAB LUXURY AND VALUE—FORD'S CUSTOM CAB—

Conventional and Tilt (shown above)
Add to Ford's standard cab features all these custom "extras," and you'll see why the Custom Cab is worth its small additional cost!

- Two-tone woven nylon-saran brown and white hound's-tooth pattern seat upholstery
- Foam-rubber padding in seat cushion
- Foam-rubber padding in seat back (driver's section, Tilt Cab)
- Thermacoustic headlining backed by one-half inch of glass wool insulation
- Sound deadener on floor and rear cab panel
- Insulation on cowl wall in cab (Conventional Cab)
- Attractive hardboard door and cowl-side trim panels (Conventional Cab)
- Arm rest on left door (Conventional Cab)
- Fold-down arm rest on driver's side (Tilt Cab)
- Large dome light with manual switch
- Sun visor on right side
- Illuminated cigar-cigarette lighter
- Bright-metal grille and hooded headlight assembly (Conventional Cab)
- Bright-metal windshield reveal molding
- Bright-metal parking light rims (Standard Tilt Cab)
- "Custom Cab" emblem on each door
- Matched locks on both doors





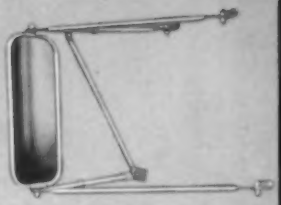
STANDARD CAB EQUIPMENT

(In addition to items listed on specification pages)

- Air Wing Ventilators in Doors
- Ammeter
- Ash Receptacle
- Cab All-Weather Ventilation (C-Series)
- Channel Front Bumper
- Choke Control
- Differential Lockout Control with Warning Light (T-Series)
- Dispatch Box
- Door Lock, Right Side
- Fuel Gauge
- Full-Wrap Windshield
- Hand Throttle
- Hi-Dri Cowl Ventilator (F- and T-Series)
- Horns, Twin Electric
- Inboard Cab Step
- Instrument Panel
- Light Switch
- Mirror, Rearview, Outside Left
- Oil Pressure Gauge
- Running Boards (F- and T-Series)
- Speedometer
- Sun Visor, Left Side
- Tachometer
- Tools
- Water Temperature Gauge
- Windshield Wipers, Dual Electric —Air on Air-Equipped Chassis

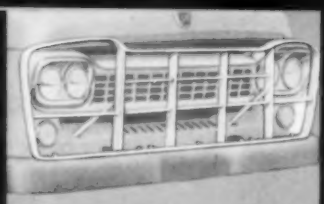
STANDARD COLORS

Choice of Vermilion, Midnight Blue, Azure Blue, Gunmetal Gray, Raven Black, Colonial White, Meadow Green, Seaspray Green, Goldenrod Yellow or Prime (F- and T-Series: on hood, fenders, cowl, cab, interior metal, inboard cab step, running boards and fuel filler cap. Any of the above colors can be combined with Colonial White for a smart Two Tone effect on the cab). (C-Series: on cab, interior metal, and inboard cab step.) Painted Raven Black are frame, door vent frame and glass channel, fuel tank, taillight, springs, axles, and wheels. Painted Colonial White are bumper, grille, dual headlight assembly, parking light rims and outside rearview mirror. Headlights and parking light rims are bright-metal on C-Series.



Full-view mirror (Western type) has a large 6 x 16 inch reflecting surface for maximum side and rear visibility. Adjustable arms and mirror.

Front-end power take-off for front-mounted pump, etc. Power take-off unit consisting of damper assembly and jack shaft available on Ford F- and T-Series.



Heavy-duty grille guard is braced to truck frame for grille, radiator and headlight protection. Rugged bar steel construction. Tow hooks also available.

Full-wrap rear window provides wide-angle visibility. Over 766 sq. in. available on F- & T-Series for Standard or Custom Cabs. Bright-metal molding around window.

FORD Accessories and Optional Equipment in addition to those previously shown:

REGULAR PRODUCTION OPTIONS

Air Horns, on air equipped models
Arm Rest, Left (Standard Cab)
Cab, Custom
Carrier, Spare Wheel
Heater and Defroster, MagicAire or Recirculating
Hydraulic Jack, 5-ton (F- & C-850), 8-ton (F- & C-950, 1000 & 1100; T-850 & 950)
Padded Instrument Panel and Cushioned Visors
Radio
Spare Tire, Tubeless
Sun Visor, right side (Standard Cab)
Tinted Glass
Tube-Type Tires
Turn Signals, Front & Rear
Windshield Washers
Wheels & Tires (Tubeless)

F- & C-850

(7) 22.5 x 7.5 Rims
(7) 22.5 x 7.5 Disc Wheels, 8-hole or 10-hole type
(6) 11-22.5 12 PR Tires*

**Heavy Duty rear springs and 7.5 rims or wheels required.*

F- & C-950, 1000 & 1100

(7) 22.5 x 8.25 Rims
(7) 24.5 x 8.25 Rims
(7) 22.5 x 7.5 Disc Wheels, 10-hole
(7) 22.5 x 8.25 Disc Wheels, 10-hole
(7) 24.5 x 8.25 Disc Wheels, 10-hole
(6) 11-24.5 12 PR Tires*
(6) 12-22.5 12 PR Tires*
(6) 12-24.5 12 PR Tires*
(6) 12-22.5 14 PR Tires*

**Heavy Duty rear springs and 8.25 rims or wheels required.*

T-850

(11) 22.5 x 7.5* Rims
(11) 22.5 x 6.75** Disc Wheels, 8-hole
(11) 22.5 x 7.5* Disc Wheels, 8-hole
(11) 22.5 x 7.5† Disc Wheels, 10-hole
(10) 10-22.5 10 PR Tires**
(10) 11-22.5 12 PR Tires*‡

**For highway operation only if used with 28,000-lb. axle.*
***With 28,000-lb. axle only.*
†With 34,000-lb. axle only.
‡22.5 x 7.5 rims or disc wheels required.

T-950

(11) 22.5 x 8.25 Rims
(11) 24.5 x 8.25 Rims
(11) 22.5 x 7.5 Disc Wheels, 10-hole
(11) 22.5 x 8.25 Disc Wheels, 10-hole
(11) 24.5 x 8.25 Disc Wheels, 10-hole
(10) 11-24.5 12 PR Tires*
(10) 12-22.5 12 PR Tires*
(10) 12-24.5 12 PR Tires*
(10) 12-22.5 14 PR Tires*

**8.25 rims or wheels required.*

PRE-APPROVED OPTIONS

Arm Rest, Right Side for All Cabs
Cigar Lighter (Standard Cab)
Dome Light (Standard Cab)
Generator, Ford, 40 amp., 600 watts
Generator, 50 amp., 750 watt (T-850, T-950)
ICC Clearance Lights
Mirrors: Inside Safety;
Outside—Right, Non-Telescopic;
Left or Right, Telescopic (except C-Series)
Shock Absorbers, front (Std. on C-Series)
Spare Tire, Tube-type
Taillight, Right
Turn Signals, front only
Vacuum Reserve Tank, 1,000 cu. in. (F- & C-850, 950)

ACCESSORIES—DEALER INSTALLED

Fire Extinguisher
Locking Gas Tank Cap
Reflector Flares (3 in Kit) with Flags
Seat Belts
Seat Covers
Seat Cushion, Ventilated
Shaver, Electric
Splash Guards

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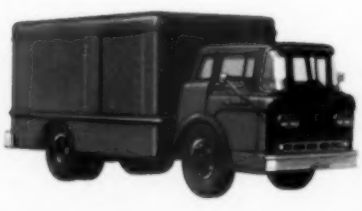
FORD Division of FORD MOTOR COMPANY • DEARBORN, MICHIGAN



Printed in U.S.A. —1/58

Form No. T-3158

Wire-line spooling:

Counterbalance, single-crossover pyramid, helical

DUE TO increasing demands for heavy industry, the problem of spooling wire line demands more attention in the technical solution of better spooling.

This series includes the most practical and economical solution to wire-line spooling for all phases of industry concerned with problems of spooling wire line.

The first duty of any hoisting machine designed for work by the medium of wire rope is to spool wire line on and off the hoisting drum.

The type of hoisting to be done along with the weight of the load, size of the line and height to be raised and lowered, all add to the complex problems involved in wire-line spooling.

The grooved-drum spooling methods described briefly here are improvements on the original plain-drum spooling. These grooved-drum spooling methods are counterbalance double-crossover pyramid (the most modern); single-crossover pyramid; and helical spooling. Each method of spooling is determined by the pattern of the foundation layer of line which in turn is controlled by the pattern of the grooving.

Counterbalance . . . The latest system to be put into use employs the use of two crossover areas located 180° apart. Each crossover moves only one-half the line diameter each time with the two parallel sections being offset one-half pitch from the other. See Fig. 1.

This new system counterbalances the line action and allows an unlimited amount of line to be spooled in a uniform pyramid pattern. It reduces the angle of the crossover, eliminates cutting in and allows faster spooling with less line scrubbing and whip. It is an improvement over the single-crossover pyramid system and has been proved better for 2 to over 30 layers of line for extra-heavy hoisting at fast or slow speeds.

Taken from Lebus-International Engineers, Inc., wire-line-spooling handbook.

Counterbalance is ideal for fast or slow multilayer spooling and extra-heavy loads.

Single-Crossover Pyramid

On this spooling, the line proceeds parallel to the drum flanges 70 to 80 per cent of the circumference, then crosses over to the next pitch at one pass. The entire crossover is controlled at one position on the drum. This spooling builds a uniform pyramid section of wire line (Fig. 2).

Pyramid has proved satisfactory for spooling two or three layers of line at moderate speeds and moderate loads and where the line is not worn excessively. With the spooling of more than three layers, cutting-in hazards increase and the drum may become out of balance due to the buildup of line on the section at the crossover.

These characteristics prove to be very unsatisfactory when handling heavy loads at slow or high speeds.

Helical

This is the oldest grooved-drum method in use and derives its name from the manner by which the line is made to spool on the drum. With the rotation of the drum the line is spooled forward in a threaded or helical fashion (Fig. 3).

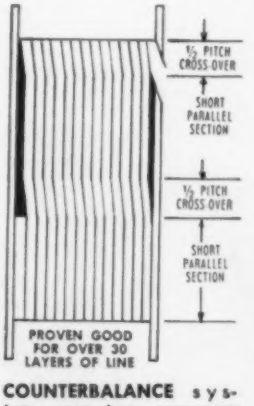
Helical spooling is ideal for spooling one layer of line. When two or more layers of line are spooled, helical spooling is not satisfactory due to the second layer being spooled against the helix made by the foundation layer. It is impossible to control the crossover points in helical spooling, thus eliminating its value for multilayer spooling.

Plain Drum Cores

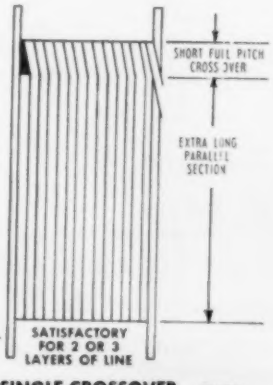
Smooth drum cores were considered standard engineering by some manufacturers from the early day beginning of the manufacture of power hoisting equipment.

They reasoned that the purchasers and operators of hoisting equipment could use any size wire line for a predetermined requirement and if excess differential in the weight to be hoisted became necessary, the line size could be changed. Also the wire-rope tolerances were a major problem when a grooved drum was used.

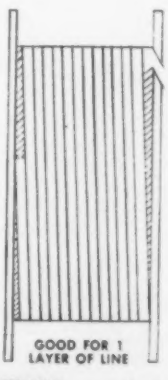
Another of the principal reasons for smooth drum cores was that the operators had a problem with line that had been pulled down or worn. The operators reasoned that the line could be hand spooled so that, as the line wear occurred, the wraps could be hammered up close together to help eliminate cutting-in behavior of line.


½ PITCH CROSS OVER
SHORT PARALLEL SECTION
½ PITCH CROSS OVER
SHORT PARALLEL SECTION
PROVEN GOOD FOR OVER 30 LAYERS OF LINE

COUNTERBALANCE system uses two crossover moves. Fig. 1.



SINGLE-CROSSOVER pyramid uses uniform crossing. Fig. 2.



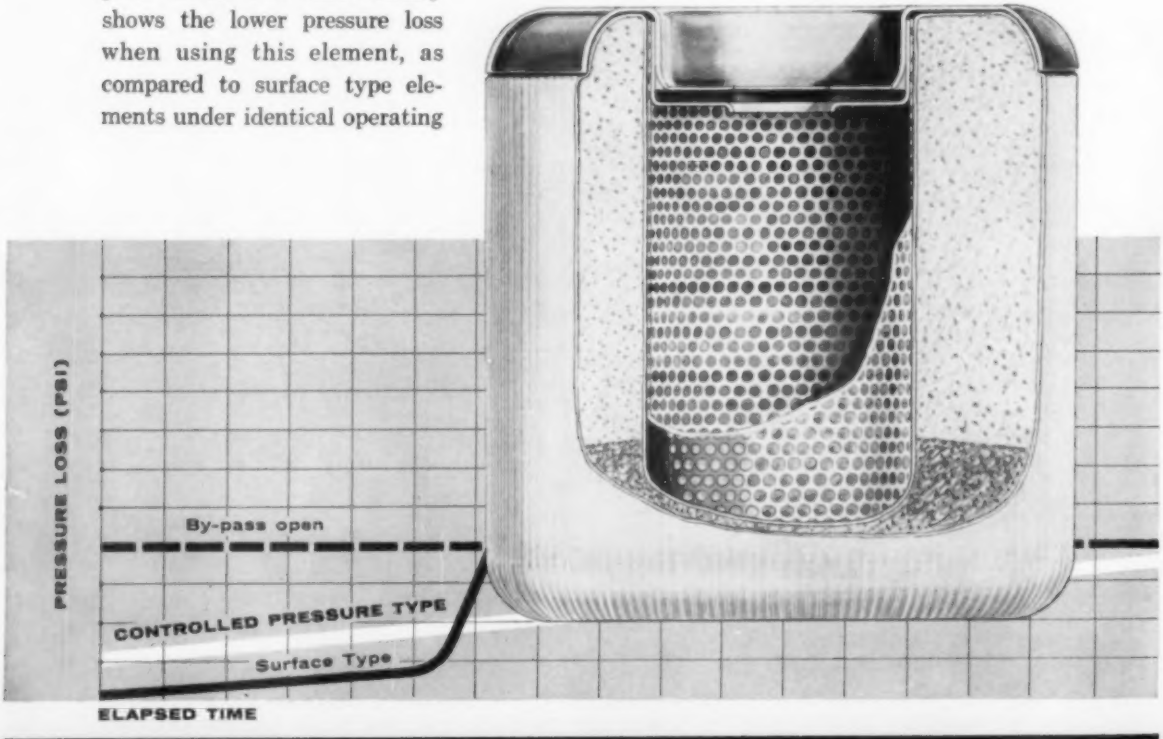
HELICAL method threads line. Fig. 3.

FORD STANDARDIZES ON DEPTH-TYPE FULL-FLOW FILTERS FOR HEAVY-DUTY TRUCK ENGINES

After exhaustive testing, Ford Motor Company has standardized on full flow type filter elements to insure maximum lubrication efficiency on its heavy duty truck engines. Regardless of service or weather conditions, full flow filtration of all lubricating oil will add further savings to the already established economical performance record of Ford trucks.

Exclusive Controlled Pressure Feature

The combination of two types of material within the same element is a patented feature of this full flow filter. This double flow capacity continuously self-adjusts pressure within the filter to allow for a full flow of filtered oil without opening by-pass valves. The chart clearly shows the lower pressure loss when using this element, as compared to surface type elements under identical operating conditions . . . how this element will extend the useful life of the oil. Reduced lubricating oil cost and greatly reduced engine wear are advantages indicated to Ford truck owners by the use of this filtration system.



FORD DIVISION OF FORD MOTOR COMPANY

BY W. L. NELSON, Technical Editor

Nelson Operating Cost Index

THE COST of operating refinery or process units can be described in terms of such basic costs as those for fuel, labor, investment (repairs, interest on investment, obsolescence, taxes, etc.), and chemicals. Purchases of power, and money spent for research (or royalties) contribute only a small proportion of the operating cost, and they may be neglected because such costs rise and fall at somewhat the same rate as the basic costs enumerated above.

The Nelson Operating Cost Index for refineries is based on the costs of the following basic elements or components:

	Per cent
Fuel	15
Labor	40
Investment	30
Chemicals	15

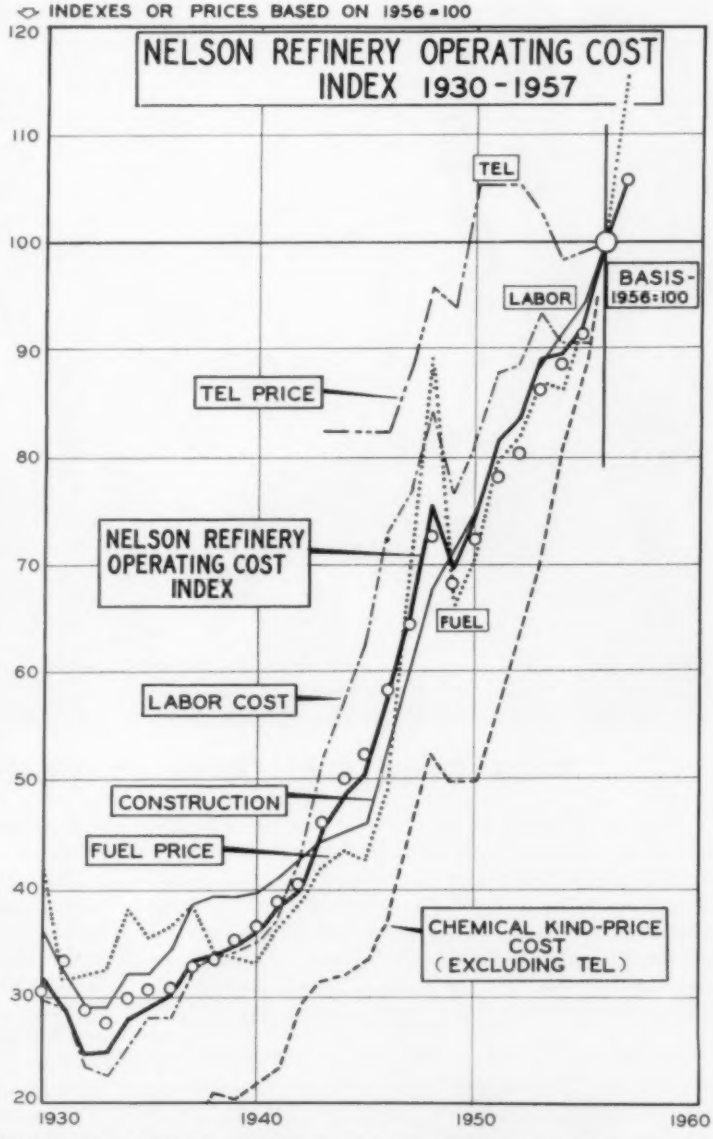
For individual process unit operating costs, the following proportions, which excludes chemicals, are employed:

	Per cent
Fuel	20
Labor	50
Investment	30

If significant amounts of chemicals or catalysts are employed in the process, then these can be added to the operating cost using proper prices for the years under consideration.

These proportions were selected not alone by a consideration of actual costs of the past, but by judging the probable importance of the cost elements in the future. Fig. 1 shows the behavior of the Nelson Refinery Operating Cost Index since 1930, as well as the behavior of the several components (fuel, labor, construction, and chemicals) which compose the index. The circle points are the best judgment of actual operating costs during the same period, and the minor departures of the index from the actual points can be explained by an examination of the behavior of the several components of the index. Thus during 1930-36, the high fuel price is not weighted heavily enough by the index, whereas during 1941-46, when the fuel component is satisfactory, the cost of labor is not weighted heavily enough. Finally, during 1949-54, the index is weighted too heavily by the cost of chemicals (primarily TEL). However, the index is believed to be as good a weighting of the several components as is now possible, and it is believed that it may safely be used for at least 10 years in the projection of refinery operating costs.

Fuel component (15 per cent) . . . This is the average price of refinery fuel based on 1956 (27.8 cents per



BEHAVIOR of the Nelson Refinery Operating Cost Index since 1930, as well as the behavior of the several components which compose the index. Fig. 1.

This Man Can Add to Your Profit Picture

This is a Dowell service engineer—on the job. His knowledge and abilities in chemical cleaning can help you to greater profits. Recently, an eastern corporation used Dowell Service for its boiler cleaning maintenance. Dowell's service engineer studied the problem, did the job. His use of chemical solvents in cleaning tubes and other metal surfaces was effective. On the basis of Dowell Service, this company will realize improved profits of $440,000.

There are three ways you can clean your plant equipment: *Mechanically* with your own crews—inefficient, time consuming and expensive in today's industrial pace. *Chemically* with your own crews—again inefficient and unprofitable because of heavy payroll and the personnel's lack of qualification. Or with *Dowell Service,* the modern chemical cleaning method.

With Dowell Service you receive the benefits of more than fifteen years experience in chemical cleaning—plus special equipment, chemicals, research and trained personnel. You pay one charge, get an efficient job, handled by knowledgeable people.

Every industry can profit from Dowell Service. Ask your maintenance and operating engineers if they have thoroughly investigated the profit possibilities of using Dowell Service. DOWELL INCORPORATED—A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY. Headquarters and research center, Tulsa, Oklahoma; 165 offices and stations to serve you.

Chemical cleaning service for industry DOWELL

TABLE 1—COMPONENTS (INDEXES) OF THE NELSON OPERATING COST INDEXES SINCE 1926. (1956 = 100)

	Fuel cost*	Labor cost†	Replacement cost‡	Chemical cost¶	Nelson Operating Index: Refineries	Nelson Operating Index: Units§
1926	61.0	31.0	36.8	9.6	40.1	46.4
1928	44.6	29.5	36.4	8.7	34.8	40.2
1930	41.2	29.5	36.0	19.6	35.5	38.7
1931	31.6	29.0	32.2	16.9	33.3	36.8
1932	29.4	23.5	29.0	12.8	28.9	32.3
1933	32.7	22.5	29.0	14.6	27.6	30.3
1934	38.0	25.0	32.1	17.8	29.8	32.2
1935	35.6	28.0	32.1	18.2	30.8	33.5
1936	36.6	28.0	34.4	19.6	30.9	33.2
1937	38.6	32.0	38.2	21.0	32.8	35.2
1938	34.3	34.0	39.3	21.9	33.6	36.0
1939	33.7	34.0	39.2	27.8	35.1	36.6
1940	33.3	35.0	39.7	32.8	36.5	37.2
1941	36.2	37.0	41.0	37.0	38.7	39.0
1942	38.7	43.0	42.8	26.9	40.4	43.2
1943	42.0	52.0	44.3	33.3	46.2	48.7
1944	43.5	57.5	45.1	37.4	50.2	52.8
1945	42.7	62.0	46.0	37.4	52.5	55.5
1946	49.6	73.1	51.2	37.0	58.5	62.9
1947	68.8	77.0	59.8	43.3	64.6	76.5
1948	89.5	84.9	67.8	53.4	72.8	76.8
1949	66.0	76.9	71.5	52.5	68.2	71.3
1950	70.3	81.5	74.8	59.3	72.4	75.1
1951	79.6	88.0	80.5	67.0	78.1	80.5
1952	81.0	88.7	83.6	72.1	80.5	82.2
1953	87.0	93.5	88.8	81.7	86.3	87.3
1954	86.5	90.9	92.0	85.7	88.7	88.4
1955	93.0	90.6	94.2	92.1	91.6	91.5
1956	100.0	100.0	100.0	100.0	‖100.0	**100.0
1957	115.7	105.7	105.3	102.2	106.8	107.5

*Includes changes in fuel consumption.
†Includes productivity as well as wages.
‡Nelson Refinery Construction Cost Index corrected to a 1956 basis.
¶Includes TEL and the changes that have occurred in the kinds of chemicals.
§Does not include the chemicals or catalysts used in the process. Apply separate corrections.
‖$1.025 per barrel during 1956.
**$1.27 per barrel during 1956.

million B.t.u.) as will be indicated in Part 3 of this series, to be published next week. It is the weighted average of Bunker C prices at five points (Gulf, New York, San Pedro, Central Michigan, and Oklahoma) with 35 per cent natural gas fuel (primarily from Texas). Fuel-oil prices will be published each quarter (January, April, July, and October) on the Itemized Cost Index page of The Oil and Gas Journal. The number of B.t.u. required per barrel of crude oil is published each year by the U. S. Bureau of Mines. From time to time the fuel component will be corrected for the amount of fuel required.

Labor component (40 per cent) . . . Refinery wages and the number of refinery employes are published each month in the Department of Labor magazine entitled "Employment and Wages," and this information as well as refinery runs will be published each quarter on the Itemized Cost Index page of The Oil and Gas Journal. The Labor Cost Index based on 1956 = 100, is

$$\text{Wage Index} \times \text{Productivity Index}$$

$$\text{or} \quad \frac{\text{Weekly wages}}{108.39} \times \frac{\text{Refinery runs (B/D)}}{\text{Total employes}} \times \frac{254.5}{10{,}000}$$

The $108.39 was the weekly wage during 1956, and 254.5 was the number of employes per 10,000 bbl. per day of capacity during 1956.

Investment component (30 per cent) . . . This is the Nelson Construction Cost Index published each month in The Oil and Gas Journal, corrected however, to a basis of 1956 = 100. This component represents replacement value of the installation and is the basis of such costs as interest or dividends on capitalization (3-6 per cent of replacement cost per year), property taxes and insurance (about 2 per cent), obsolescence (0.5 to 5 per cent), and to some extent, maintenance materials.

Chemicals and TEL (15 per cent) . . . The price of TEL is readily available, and the amount used can be judged from the number of milliliters currently being used per gallon of gasoline. The amounts, prices, and kinds of other chemicals, catalysts, etc., presents more difficulty. The prices can be ascertained from the average prices of industrial chemicals, but the kinds of chemicals being used must be reappraised at intervals to account for the advent of new processing methods.

Prices of industrial chemicals and TEL will be published each quarter on the Itemized Cost Index page of The Oil and Gas Journal.

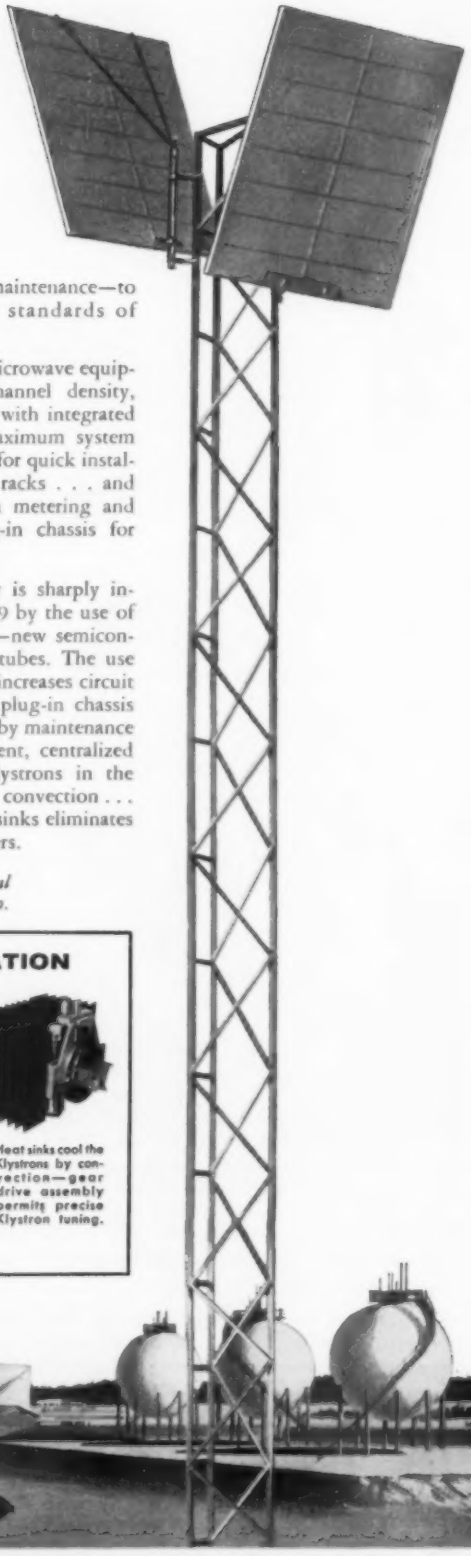
Scarcely any information is available for checking the validity of the new Nelson Operating Cost Index. However, pages 551, 553, and 554 of "The Growth of Integrated Oil Companies" (Harvard Graduate School of Business Administration) by McLean and Haigh, presents operating costs for six widely separated years, and a gross approximation can be obtained from the gross refinery margins published on the Questions on Technology page of December 6, 1954 ("What Are Average Costs of Refining?"). When these are converted to a common basis of 72.4 for 1950 (the 1950 value of the Nelson Operating Cost Index) they compare as follows:

	Nelson Operating Cost	McLean and Haigh: p. 551-554	McLean and Haigh: p. 546-554*	Questions on Technology
1910	....	....	10.2	....
1915	....	14.5	15.9	....
1921	....	....	....	81.5
1927	37.5	31.1	14.8	48.0
1935	30.8	31.3	23.9	37.8
1946	58.5	55.2	56.5	45.0
1947	64.6	....	....	81.6
1950	72.4	72.4	72.4	72.4
1956	100.0	....	....	....

*Not entirely applicable, because very different types of refineries were considered.

The Nelson Operating Cost Index is not the same as, and should not be confused with, various other approximations or operating indexes published by W. L. Nelson in The Oil and Gas Journal since 1947. These older approximations check reasonably well, however, with the new index.

Reliable, unattended microwave operation for pipeline communications and control!



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Philco CLR-9 microwave delivers outstanding system reliability, economy of installation and operation, simplified equipment maintenance for dependable pipeline communications. With 240 voice channel baseband capacity—for telephone, telemetering and remote control—and capability for handling high-speed computer data transmission—Philco microwave fills both immediate and long-range requirements of modern pipeliners.

Philco's complete turnkey service includes—*site surveys* by competent survey engineers experienced in field techniques; *system planning* by Philco's systems engineers who design your complete communications system; *installation* of your microwave system by Philco field engineers—including erection of towers and shelters; and, Philco field engineers are available for *field service*—periodic inspection and preventive maintenance—to maintain the highest standards of system performance.

Philco's new CLR-9 microwave equipment provides high channel density, duplex communications with integrated standby facilities for maximum system reliability. It is designed for quick installation in standard relay racks . . . and engineered with built-in metering and test facilities plus plug-in chassis for easy field maintenance.

Performance reliability is sharply increased in the new CLR-9 by the use of tubeless power supplies—new semiconductor rectifiers replace tubes. The use of printed wiring panels increases circuit stability—and complete plug-in chassis may be quickly removed by maintenance personnel (permits efficient, centralized depot maintenance). Klystrons in the new CLR-9 are cooled by convection . . . the use of compact heat sinks eliminates the need for bulky blowers.

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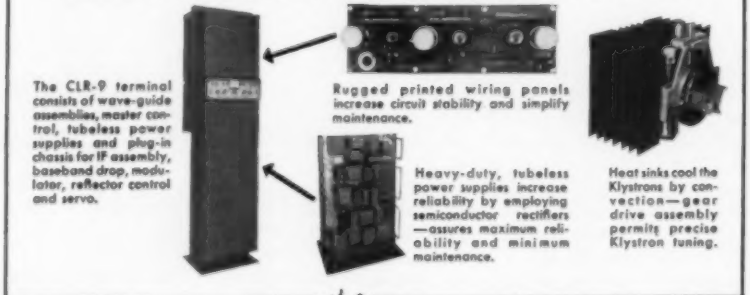
NEW PHILCO CLR-9 MICROWAVE STATION

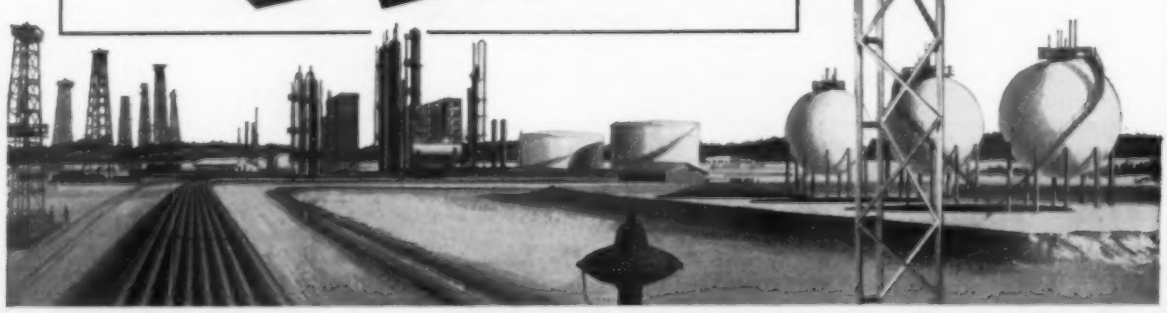


The CLR-9 terminal consists of wave-guide assemblies, master control, tubeless power supplies and plug-in chassis for IF assembly, baseband drop, modulator, reflector control and servo.

Rugged printed wiring panels increase circuit stability and simplify maintenance.

Heavy-duty, tubeless power supplies increase reliability by employing semiconductor rectifiers—assures maximum reliability and minimum maintenance.

Heat sinks cool the Klystrons by convection—gear drive assembly permits precise Klystron tuning.



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PIPELINE

CONSTRUCTION REPORT

Who's Laying Line—and Where

PIPELINE activity reported here is compiled from surveys conducted by The Oil and Gas Journal among pipeline companies and contracting firms. Projects listed include those proposed, contracted, and under way.

U.S. Crude-Oil Pipelines

- **Belle Fourche Pipeline Co.**
  Project: 30 miles of 6-in. from Donkey Creek pool to Fiddler Creek pool in northeastern Wyo. Will later build a line from Fiddler Creek to connect with Butte Pipe Line Co. near Osage, Wyo.
  Status: Planned.
- **Cape Pipe Line Co.** (Sun Oil Co., Cities Service Co., Atlantic Refining Co.)
  Project: Line from lower Delaware Bay to Philadelphia.
  Status: Planned.
  Completion: 1960.
- **Gillette Pipeline, Inc.** and **A. W. Hartwig, Inc.**
  Project: A 102-mile line from Dead Horse Creek field to Casper, Wyo.
  Status: Has applied for permit from Wyoming Public Service Commission.
- **Great Northern Railway Co.**
  Project: 400 to 600 miles of 12 to 20-in. from Williston basin in Montana and North Dakota, to Clearbrook or St. Paul, Minn.
  Status: Planned.
  Contractor: **Pipe Line Technologists, Inc.** has completed feasibility study.
- **Humble Pipe Line Co.**
  Project: 90 miles of 16-in. from Hawley to Comyn, Tex.
  Status: Under way.
  Contractor: **O. R. Burden Construction Corp.**, R. M. Jones, supt., office at Cisco, Tex.
  Completion: Summer 1958.
- **Jayhawk Pipeline Corp.** (Colorado Oil & Gas Corp., National Cooperative Refinery Association)
  Project: 242 miles of 10 and 12-in. from western Meade County, Kansas, to Valley Center near Wichita.
  Status: Will start spring 1958.
  Contractor: **Pipe Line Technologists**, Houston, has engineering contract.
  Completion: August 1958.
- **Offshore Gathering Corp.**, Houston.
  Project: 364 miles of mostly 20-in. in Gulf of Mexico off Louisiana. (Dual line.)
  Status: Proposed.
- **Oil Field Pipe Line, Inc.**
  Project: 200 miles 8 and 12-in. from near Elkhart, to Ellinwood, Kans.
  Status: Proposed.
- **Portland Pipe Line Corp.** and **Montreal Pipe Line Co., Ltd.**
  Project: 39 miles of 24-in. loops in U. S. and 11 miles in Canada along its 242-mile dual 12 and 18-in. system between Portland, Me., and Montreal, Que.
  Status: To start spring 1958.
- **Service Pipe Line Co.**
  Project: 75 miles of 20-in. between Casper and Laramie, Wyo.
  Status: Planned.
  Completion: Summer or fall 1958.
- **Shell Oil Co.**
  Project: 17 miles of 3, 4-in. in La. Delta area.
  Status: Under way.
  Contractor: **Brown & Root, Inc.**, W. P. Stanley, supt., office at Buras.
  Completion: March 31, 1958.
- **Shell Pipe Line Corp.**
  Project: 11 miles of 8-in., 3 miles of 10-in., 10 miles of 12-in., 37 miles of 16-in., and 60 miles of 20-in. from Mississippi River Delta area to New Orleans refining area.
  Status: Planned.
  Contractor: **Coates Field Service, Inc.**, has right-of-way acquisition and claims settlement.
  Completion: September 1958.
- **Sinclair Pipeline Co.**
  Project: 150 miles of 20-in. from Teague, Tex., to Houston.
  Status: Under way.
  Contractor: **Lone Star Constructors, Inc.** has 143 miles; **Golightly Construction Corp.** has 6 miles.
  Completion: June 1958.
- **Southern Kansas Pipeline, Inc.**
  Project: 200 miles of 6 to 10-in. in Kans. from southwestern Meade County to 10 miles north of Arkansas City.
  Status: Proposed. Request filed with Kansas Corporation Commission for permit.
- **Texas-New Mexico Pipe Line Co.** (Sinclair, Texas Co., Tidewater, Empire)
  Project: 512 miles of 16-in. from southeast corner of Utah to Jal, N. M.
  Status: Under way.
  Contractor: **Four Way Co., Inc.**, has 150 miles from Aneth field southeast. **Panama, Inc.**, has remaining 362 miles from Cuba to Jal to complete March 1, with two spreads; T. F. Rashell, supt., office at Estrancia, and Eugene Coulter, supt., office at Roswell.
  Completion: May 1958.
- **Toronto Pipeline Co.**
  Project: System to connect fields in Cheyenne, Morrill, and Banner counties, Nebr., to Platte Pipe Line Co.'s 20-in. line from Wyoming to Wood River, Ill., and 13 miles of 4-in. plus field lines to Platt's Redding station.
  Status: Planned.

U.S. Products Pipelines

- **Alaska-Yukon Refiners & Distributors, Ltd.**
  Project: Two lines: one 150 miles from Haines to Haines Junction, Alaska, linking with government Canol line; another from Tok Junction, on Canol line, to Anchorage.
  Status: Proposed.
  Completion: 1959.
- **American Pipe Line Co.**
  Project: Line from Gulf Coast to New York City. Has ODM approval to amortize 40 per cent of cost with fast writeoff.
  Status: Proposed.
- **Buckeye Pipe Line Co.**
  Project: 70 miles of 8-in. from Wayne to vicinity of Durand, Mich.
  Status: Planned.
  Completion: 1958.
- **Cherokee Pipe Line Co.** (Continental Oil Co., Cities Service Oil Co.)
  Project: 78 miles of 12-in. from Ponca City to Tulsa, Okla.
  Status: Under way.
  Project: Conversion of 400 miles of 10-in.

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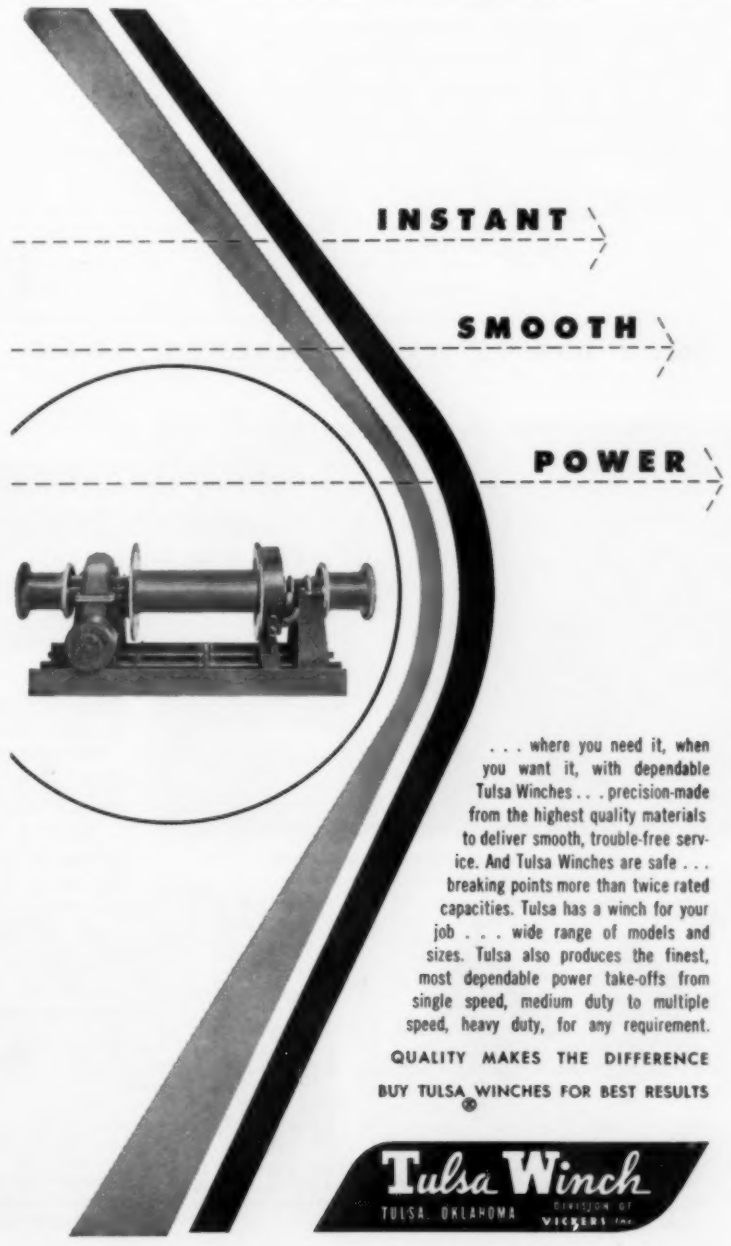
PIPELINE CONSTRUCTION

crude line between Glenpool, Okla., and Wood River, Ill.
Status: Planned.

- **Clark Oil & Refining Co.**
Project: 15 miles of 8-in. from Blue Island, Ill., to Hammond, Ind., area.
Status: Planned.
Completion: Mid-1958.
- **Columbia Gas System, Inc.**
Project: Line from proposed plant near Kenova, W. Va., to proposed plant and storage facilities at Siloam, Ky.
Status: Planned.
- **Conn-Mass Pipe Line, Inc.**
Project: 62 miles of 8-in. and 7 miles of 6-in. from New Haven, Conn., to Springfield, Mass.
Status: Proposed.
Contractor. **Coates Field Service, Inc.,** has right-of-way acquisition and claims settlement.
Project: 88 miles of 8-in. from Boston to Springfield, Mass.
Status: Proposed.
Project: 133 miles of 16-in. from Linden, N. J., to Hartford, Conn.
Status: Proposed.
Project: 38 miles of 6-in. from Waltham to Fitchburg, Mass.
Status: Proposed.
- **Everglades Pipe Line Co.**
Project: 60 miles of 10-in. from Port Everglades, Fla., to Miami's International Airport and terminals south.
Status: Under way.
- **Gulf Refining Co.**
Project: 60 miles of 8-in. propane and natural gasoline line from Barbers Hill to Port Arthur, Tex.
Completion: March 1958.
- **Katy and New York Central Railroads**
Project: 2,000 miles of 10 or 12-in. from Houston through Kansas City, St. Louis, Indianapolis and Cleveland to Syracuse then down to New York City. A branch would go through Chicago to Detroit.
Status: Planned.
Contractor: **Williams Brothers Co.** has feasibility study.
- **Laurel Pipe Line Co.** (Gulf Refining Co., Sinclair Pipe Line Co., The Texas Co.)
Project: 100 miles of 24-in. and 340 miles of line graduating down to 14-in. at the west terminus, from Philadelphia to Cleveland.
Status: To start April 1958.
Contractor: **Pipe Line Maintenance & Construction Co.,** Camp Hill, Pa., has Susquehanna River crossing. **Missouri Valley Dredging Co.,** Omaha, Neb., has 6 miles of 24-in. from Eagle Point, N. J., to west bank of Delaware River, including Delaware River crossing, and 20 miles of 24-in. from west bank of Delaware River to Laurel's Booth station site in Delaware County, Pennsylvania. **Engineers Limited Pipe Line Co.,** San Francisco, has 106 miles of 24-in. from Booth station to Mechanicsburg station near Harrisburg, Pa. **Panama, Inc.,** Houston, has 78 miles of 20-in. from Mechanicsburg station to Duncansville station, and 113 miles of 18-in. from there to Aliquippa station in Beaver County, Pennsylvania, including Allegheny and Ohio rivers crossing. **Williams Brothers Co.,** Tulsa, has 106 miles of 14-in. from Aliquippa station to Cleveland.
Completion: August 1958.
- **Leonard Refineries, Inc.**
Project: 43 miles of 6-in. from Alma to Lansing, Mich.
Status: Planned.
Contractor: **Welded Construction Co.**
Completion: Spring 1958.
- **Ohio Oil Co.**
Project: 265 miles of 12-in. from Wood River, Ill., to Chicago.
Status: Planned.
Completion: 1958.
- **Underground Storage & Exploration, Inc.**
Project: 393 miles of 12-in. L.P.G. line from Moundsville, W. Va., to Newark, N. J., plus 95 miles of 6, 8-in. laterals to Mauch Chunk, Pa., and to Philadelphia.
Status: Proposed.
- **Union Oil Co. of California**
Project: 815-mile line from Rifle, Colo., to Los Angeles refining area.
Status: Proposed.

U.S. Natural-Gas Pipelines

- **American Louisiana Pipe Line Co.**
Project: 7 miles of 16-in. and 5 miles of 12-in. from Second Bayou to Cameron, La.
Status: Under way.
Contractor: **Ford, Bacon & Davis Construction Corp.**
Completion: December 1958.
- **Arkansas Louisiana Gas Co.**
Project: A 300-mile line, plus gathering lines, from Tex.-La. coastal area to northern La., to connect with present system.
Status: Long-range plans.
- **Carnegie Natural Gas Co.**
Project: Two parallel lines to provide coke-oven gas to six Pittsburgh area plants: 9 miles of 55-in. and 4 miles of 43-in. each.
Status: Under way.
Contractor: **Williams Brothers Co.**
Completion: January 1, 1959.
- **Chicago District Pipeline Co.**
Project: 52 miles of 30, 36-in. between Joliet and Chicago, Ill.
Status: Approved by FPC examiners.
Completion: 1958.



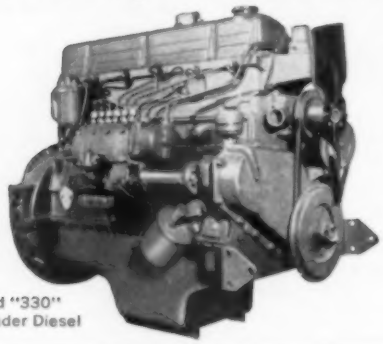
. . . where you need it, when you want it, with dependable Tulsa Winches . . . precision-made from the highest quality materials to deliver smooth, trouble-free service. And Tulsa Winches are safe . . . breaking points more than twice rated capacities. Tulsa has a winch for your job . . . wide range of models and sizes. Tulsa also produces the finest, most dependable power take-offs from single speed, medium duty to multiple speed, heavy duty, for any requirement.

QUALITY MAKES THE DIFFERENCE

BUY TULSA WINCHES FOR BEST RESULTS

Tulsa Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc.

NOW, another modern diesel from FORD



Ford "330" 6-cylinder Diesel

330 cu. in. displacement

For dependable, heavy-duty service, you'll find the new Ford "330" Diesel hard to beat. It is quality-built throughout for quick all-weather starting, dependable performance and top operating economy.

Ford "330" Diesel features include: removable "wet" cylinder sleeves that eliminate costly reboring; Four-Way Injectors for greater economy; and rotating exhaust valves for better seating, longer life.

For power that's right for your particular application, choose either the new Ford Heavy Duty "330" Diesel or the Ford "220" Diesel.

ENGINE SPECIFICATIONS		"220"	"330"
Basic Model		X	Y
Number of Cylinders		Four	Six
Bore and Stroke—Inches		3.94 x 4.52	3.94 x 4.52
Displacement—Cubic Inches		220	330
Brake Horsepower	Dynamometer	61 @ 2250	96 @ 2250
	Continuous	49 @ 2250	77 @ 2250
Torque	Dynamometer	152 ft-lb @ 1600	236 ft-lb @ 1500
	Continuous	131 ft-lb @ 1600	189 ft-lb @ 1500
Compression Ratio		16 to 1	16 to 1

Ford INDUSTRIAL ENGINES AND POWER UNITS

INDUSTRIAL ENGINE DEPARTMENT • FORD Division of FORD MOTOR COMPANY • P. O. Box 598, Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!

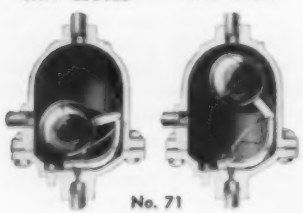
for Compressed Air and Gas Drainage

ARMSTRONG *Snap-Action* TRAPS

Assure Wide Open—Tight Shut Operation

No. 71-315 forged steel Armstrong "Snap-action" Traps draining water from natural gas scrubber.

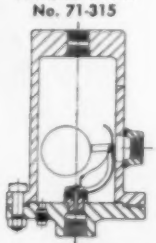
TRAP CLOSED TRAP OPEN



No. 71

Spring holds valve tight until float buoyancy overcomes spring pressure. Then spring snaps up, opening valve wide. Before all water leaves trap, valve snaps closed.

FORGED STEEL No. 71-315



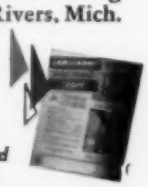
For pressures to 1000 lbs. Same mechanism as No. 71.

Positive action, no dribbling, no hunting, no gas or air loss—these are the advantages of the Armstrong "Snap-action" ball float trap with spring-powered valve. The valve is always water-sealed. Fine dirt and grit won't interfere with operation.

Don't worry about maintenance. The flat strip spring of special Swedish steel lasts for years in ordinary service. Valve and seat are hardened chrome steel. All other internal parts are stainless steel. Special materials are available for special corrosion problems.

Like all Armstrong products, these traps are *unconditionally guaranteed* to satisfy. Call your local Armstrong Representative, or write Armstrong Machine Works, 8683 Maple St., Three Rivers, Mich.

How to Select TRAPS



Free Bulletin 289 gives complete selection data on ball float traps for draining water and *light liquids*. Ask for your copy. No obligation.

PIPELINE CONSTRUCTION

• **Cities Service Gas Co.**
Project: 6 miles of 30-in. in Montgomery County, Kansas, and 18 miles of 26-in. in Anderson and Franklin counties, Kansas.
Contractor: **R. H. Fulton & Co.** has the 26-in.

• **Coastal States Gas Producing Co.**
Project: A 20-mile gathering system from the Rock Island area of Colorado County, Tex., to the United Gas Corp. system.

• **Coastal States Gas Producing Co. and Southern Coast Corp.**
Project: 45 miles of 2 to 10-in. in Bee County, Tex. to connect presently shutin fields with Texas Eastern Transmission Corp.'s system.
Status: Planned.

• **Coastal Transmission Corp.**
Project: 562 miles of 12, 20, 22, 24-in. main line and 336 miles of 2 to 14-in. gathering lines between McAllen, Tex., and Baton Rouge, La.
Status: Survey and right-of-way work under way.
Completion: January 1, 1959.

• **Colorado Interstate Gas Co.**
Project: 66 miles of 30-in., 40 miles of 34-in., 109 miles of 26-in., and 100 miles of 24-in. from Springfield, Colo., to Pubelo, Colo.; 345 miles of 30-in. from Kit Carson, Colo., to Beatrice, Neb.; 24 miles of 22-in. Tex. Panhandle looping.
Status: Approved by FPC examiners.

• **Consolidated Gas Utilities Corp.**
Project: 21 miles of 12-in. and 10 miles of 8-in. at Altus, Okla.
Status: Approved.

• **Eastern Shore Natural Gas Co.**
Project: 34 miles of 8-in. and 90 miles of 6-in. from connection with Transcontinental Gas Pipe Line Corp., in Maryland, across entire length of Delaware to Salisbury.
Status: Approved.

• **El Paso Natural Gas Co.**
Project: 95 miles of 34-in. San Juan main line loops.
Status: Under way. Partially certificated.
Contractor: **R. H. Fulton & Co.** has 28 miles. **Western Pipeline, Inc.,** has 47 miles. Remainder to be let.
Completion: April 1, 1958.
Project: 18 miles of 12-in. between Good Field in Borden Co., and the East Vealmoor gasoline plant in Howard Co., Tex.
Status: Has temporary FPC approval.
Project: 177 miles of 20-in. from Sonora plant, Sutton County, to Plains plant, Yoakum County, Texas.
Status: Planned. Filed for FPC permit.
Completion: July 1, 1958.
Project: 193 miles of 30-in. Permian-San Juan main line loops.
Status: Planned. Filed for FPC permit.
Completion: September 1, 1958.
Project: 216 miles of 6 to 34-in. and 533 miles of various size in Ariz., Tex., N. M.
Status: Filed for FPC permit.
Project: 38 miles of various size line to make additional gas available at the McElroy-Wilshire plant near Crane, Tex.
Project: 500 miles of 34-in. from Twin Falls, Idaho to California border near Las Vegas, Nev.
Status: Planned.
Completion: September 1, 1959.

• **Equitable Gas Co.**
Project: 12 miles of storage line in Lewis Co., W. Va.
Status: Approved.

• **Gulf Interstate Gas Co.**
Project: 10 miles of 12-in. supply loop to Erath field, Vermilion Parish, Louisiana, and 9 miles of various size field lines in Acadia and Vermilion parishes, Louisiana.
Status: Approved.
Project: 10 miles of 20-in. loop in Jefferson Davis and Vermilion parishes, Louisiana, and 3 miles of 6-in. loop in Cameron Parish, Louisiana.
Status: Has temporary FPC approval.
Project: 352 miles of 30-in. loop between Louisiana and Leach, Ky.; 54 miles of 24-in. lateral in Louisiana.
Status: Has temporary approval.
Completion: 1959.

• **Houston Texas Gas & Oil Corp.**
Project: 702 miles of 24-in. from Baton Rouge, La., to Kissimmee, Fla.; 139 miles of 18-in. and 101 miles of 20-in. from Kissimmee to Cutler, Fla.; 642 miles of 3 to 18-in. sales laterals in Florida. Main line to join Coastal Transmission's line from McAllen, Tex., to Baton Rouge.
Status: Under way.
Contractor: **Midwestern Constructors** has the 702 miles of 24-in.; **Harbert Construction Corp.** has remainder.
Completion: June 1958.

• **Humble Oil & Refining Co.**
Project: 250 miles of 26 or 30-in. from Southwest Texas area to Houston, plus 200 miles of various size gathering lines.
Status: Planned.

• **Iron Ranges Natural Gas Co.**
Project: 120 miles of 6, 12-in. from Mesabi Iron Range to northern Minn.
Status: Pending FPC approval.
Completion: November 1, 1958.
Project: 63 miles of 12-in. on north shore of Lake Superior.
Status: Pending FPC approval.
Completion: November 1, 1958.

• **Kerr-McGee Oil Industries, Inc.**
Project: 24 miles of 4-in. in Blocks 21, 22, and 32 to connect wells with its Breton Sound production island off the Louisiana coast.

• **Manufacturers Light & Heat Co.**
Project: 3 miles of 12-in. from Wellsville to a point in Saline Township, Ohio; 8 miles of 12-in. in Brook County, W. Va.; 4 miles of 10-in. in Ohio County, W. Va.
Status: Approved.

• **Michigan Consolidated Gas Co.**
Project: 67 miles of 10 and 12-in. between Sears and Travers City, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.;** Floyd Huduall, supt., office at Cadillac.
Project: 60 miles of 10 and 12-in. between Muskegon and Ludington, Mich.
Status: Under way.
Contractor: **Somerville Construction Co.,** jointly with **H. L. Gentry Construction,** Frank Morris, superintendent, office at Hart, Mich.

• **Michigan Gas Storage Co.**
Project: 40 miles of 12-in. and 12 miles of gathering lines from Overisal field in Allegan County to Kalamazoo, Mich.
Status: Planned.
Contractor: **Bechtel Corp.**

• **Michigan Wisconsin Pipe Line Co.**
Project: 33 miles of 4, 6-in., 2 miles of 12-in., 4 miles of 10-in., and 7 miles of 8-in. gathering lines in LaVerne Field, Harper County, Okla.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.
Project: 56 miles of 20-in. extension of LaVerne line, Harper County, Okla.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.
Project: 25 miles of 12-in. and 21 miles of 24-in. loops in Wis. and Mich.
Status: Planned. Pending FPC approval.
Completion: October 1, 1958.

• **Midwestern Gas Transmission Co.**
Project: Line from Portland, Tenn., to Minnesota-Canada border near Emerson, Man.: 670 miles of 24-in., 218 miles of 20-in, 371 miles of 16-in., 115 miles of 12-in., 70 miles of 10-in., 179 miles of 8-in., 147 miles of 6-in., 174 miles of 4-in., 106 miles of 3-in.
Status: Pending FPC approval.

• **Mookl Chemical & Gas Corp.** and **Missouri Transmission Corp.**
Project: 425 miles of 16-in. from Pottawatomie County, Okla., to St. Louis. Mookl, 1341 S. Boston, Tulsa, will build Okla. section. Missouri Transmission, Springfield, Mo., will build the Mo. section.
Status: Initial FPC filing rejected. Will refile.

• **Natural Gas Pipeline Co. of America**
Project: 389 miles of 36-in. loops along its line from Beatrice, Neb., to Chicago, to take gas from proposed line of Colorado Interstate Gas Co., and 91 miles of 30-in. loops along parts of its main line.
Status: Approved by FPC examiner.
Project: 337 miles of 30-in. between Fritch, Tex., and Beatrice, Neb., and 59 miles of 36-in. between Beatrice and Joilet, Ill., along existing system.
Status: Pending FPC approval.
Completion: 1959.

• **New York State Natural Gas Corp.**
Project: Will replace 12 miles of 20-in. with 30-in. and 13 miles of 12-in. with 20-in. in Pa.
Status: Planned.

• **North Carolina Natural Gas Corp.**
Project: 630 miles of 2 to 16-in. from near Mooresville, eastwardly across N. C.
Status: Under way.
Completion: Spring 1958.

• **Northern Natural Gas Co.**
Project: 23 miles of 24-in. loops in Nebr. and Iowa; 43 miles of 30-in. loops in Kans., Nebr., and Iowa; 169 miles of 20-in. from Farmington, Minn., to Superior, Wis.; 44 miles of 16-in. in Duluth-Superior-Iron Ranges area.
Status: Pending FPC approval.
Project: 73 miles of 20-in. from Savanna Creek to Pincher Creek fields in Alberta, Canada; 32 miles of 24-in. from Pincher Creek to Montana border; 1,100 miles of 26-in. from Montana into Minneapolis.
Status: Proposed.
Project: 1,090 miles of 2 to 16-in. branch lines to serve communities in Minn., Iowa, S. D., Nebr., Wis.
Status: Filed with FPC March 18, 1957.

• **Northern Utilities Co.**
Project: 35 miles of 16-in. in Fremont-Natrona County, Wyoming, area; 8 miles of 12-in. around Casper; 6 miles of 8-in. from Sand Draw gas field to Beaver Creek field; 12 miles of 6-in. from Beaver Creek field to the system servicing the Riverton-Lander area.
Status: Planned.

• **Offshore Gathering Corp.**
Project: 364 miles in Gulf of Mexico off Louisiana: 60 miles of 24-in., 70 miles of 26-in., 234 miles of 30-in. (Dual line.)
Status: Application pending with FPC.

• **Olin Gas Transmission Corp.**
Project: Mississippi River 3 and 8-in. crossing near White Castle, La.
Status: Under way.
Contractor: **Houston Contracting Co.,** A. J. Slovack and R. E. Thornton, supts., office at White Castle.

• **Pacific Gas & Electric Co.**
Project: 5 miles of 16-in., 160 miles of 12-in., 8 miles of 8-in. from Corning to Eureka, Calif.
Status: Under way.
Contractor: **Engineers Limited Pipeline Co.** and **Alex Robertson Co.**
Completion: June 1958.

• **Pacific Lighting Gas Supply Co.**
Project: 83 miles of 34-in. from North Coles Levee to Newhall, Calif.

These new Chevrolet heavyweights are true big-tonnage units . . . trucks built from stem to stern to save you time and money on *big* jobs. Here's all the proof you need!

Chevrolet heavy-duty models for '58 are "big truck" all the way—big-muscled and tough as they come with the industry's best known big-truck components. They're ready to move mountainous payloads with G.V.W.'s that go all the way up to 36,000 lbs. They're ready to keep you going and saving with powerful, high-torque V8's . . . durable Eaton and Timken axles . . . rugged New Process, Spicer and Powermatic transmissions . . . big, safe Hydrovac, Air-Hydraulic or Full-Air brakes . . . sturdy cast spoke or disc wheels . . . mighty Triple-Torque tandems . . . all available either as standard equipment or as extra-cost options.

Famous work-proved big-truck components such as these (and there are *many* more) are reasons why you can count on the heavyweight Chevrolet of your choice to *stay* on your job and *save* on your job! Look 'em over at your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

YOUR BEST BET'S CHEVY IF YOUR HAULING JOB IS BIG!

CHEVROLET **NEW CHEVROLET**

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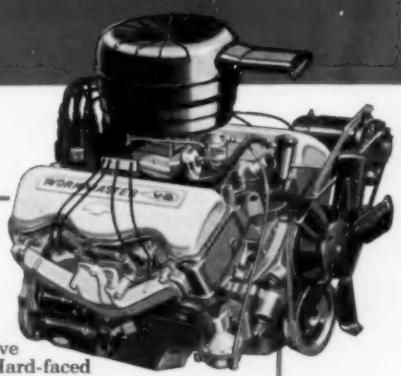
FOR RUGGED PETROLEUM RUNS!

1958 Chevrolet heavyweights with G.V.W.'s up to 36,000 lbs. (G.C.W.'s up to 50,000 lbs.) and the toughest big-truck components in the business!



BIG MUSCLE (AND HUSTLE) UNDER THE HOOD!

Revolutionary Workmaster V8, standard in Series 90 and 100. This all-new engine puts out 230 h.p. to reduce running time, 335 ft.-lbs. of torque to pull you through the tough spots . . . yet it maintains a low r.p.m. level, a moderate engine speed. This low r.p.m. factor spells *economy*—lower day-to-day costs than you've ever known before in big-tonnage hauling. It's the result of Wedge-Head design, a power and economy producing type of construction no other truck engine offers. And those rugged heavy-duty features listed at the right help provide matchless big-truck performance, too!

No other truck engine at any price gives you this complete lineup of top-quality heavy-duty features:

Valve-in-head design • Hydraulic valve lifters • Sodium-cooled exhaust valves • Positive type exhaust valve rotators • Hard-faced exhaust valves • Hardened exhaust valve seats • Induction hardened crankshaft • Fully machined combustion chamber • Chrome-plated top piston ring Moraine 400 extreme-duty bearings • Full-Flow oil filter Oil bath air cleaner • Positive crank-case ventilation • Centrifugal-vacuum type governor • Heavy-duty 5-blade fan

TASK · FORCE 58 TRUCKS

PIPELINE CONSTRUCTION

Status: Under way.
Contractor: **Engineers Limited Pipeline Co.**
Completion: **July 1, 1958.**

- **Pacific Northwest Pipeline Corp.**

Project: 40-mile line from Ute Trail gas fields in northeastern Utah to its main line in western Colorado.
Status: Planned to start spring 1958.

- **Pennsylvania Gas Co.**

Project: 23 miles of 10-in. in Erie County, Pa., 15 miles of 8-in. in Warren and Chautauqua counties, Pa., 30 miles of branch lines, several small distribution lines.
Status: Has FPC permit.

- **Permian Basin Pipeline Co.**

Project: 29 miles of 10-in. gathering lines from Crane and Pecos counties to McCamey, Tex.
Status: Under way.
Contractor: **Lone Star Constructors, Inc.**

- **Piedmont Gas Co.**

Project: 78 miles of 2 to 8-in. extension off Trancontinental in North Carolina to serve Gaston, Lincoln, Catawba, Caldwell, and Burke counties.
Status: Has FPC approval.

- **Seaboard Oil Co.**

Project: 6 miles of 10-in. in Vermilion and Lafayette parishes.
Status: Has FPC examiner's approval.

- **Shell Oil Co.**

Project: 9 miles of 6-in. from Lake Pontchartrain to Norco, La.
Status: Planned.

- **Southern Natural Gas Co.**

Project: 335 miles of 4 to 26-in. in southern La.
Status: Pending FPC approval.
Completion: December 1, 1958.
Project: 45 miles of 6 to 10-in. in southern La.
Status: Pending FPC approval.
Completion: December 1, 1958.
Project: 25 miles of 6 to 20-in. in southern La.
Status: Pending FPC approval.
Completion: December 1, 1958.

- **Tennessee Gas Transmission Co.**

Project: 556 miles of 30-in. from Mississippi Delta area south of New Orleans to Portland, Tenn.
Status: Has temporary FPC approval.
Project: 76 miles of 24-in. from Coudersport, Pa., to Hamburg, N. Y.
Status: Has temporary FPC approval.
Project: 163 miles of 30-in. and 101 miles of 26-in. from Portland, Tenn., to near Lancaster, Ky.; from Winchester, Ky., to Morehead, Ky.; from Catlettsburg, Ky., toward Broad Run, W. Va.; from New Wilmington, Pa., to Mercer, Pa.; and from Morehead, Ky., to Catlettsburg, Ky.
Status: Has Temporary FPC approval.
Project: 10 miles of 12-in. extension of system in Gulf of Mexico to terminate at CATC Group's Block 59 field.
Status: Under way.
Completion: Mid-March 1958.

- **Texas Eastern Transmission Corp.**

Project: 17 miles of 8-in. and 3 miles of 6-in. from its 20-in. Baytown-Hankamer line to Alco-Mag field in Harris County, Texas.
Status: Has FPC approval.
Project: 140 miles of 30-in. between Kosciusko, Miss., and Uniontown, Pa., 105 miles of 30-in. between Opelousas, La., and Kosciusko, 22 miles of 14-in. supply line in La.
Status: Pending FPC approval

- **Texas Illinois Natural Gas Pipeline Co.**

Project: 860 miles of 30-in. looping of present system.
Status: Planned.
Completion: 1960-1961.

- **Transcontinental Gas Pipe Line Corp.**

Project: 202 miles of 36-in. and 132 miles of 30-in. main line loop; 164 miles of 24-in. to connect storage in Pa.; 202 miles of 10 to 20-in. gathering lines in southeast La.; 48 miles of 10 to 20-in. to tap gas off Tex.
Status: Pending FPC approval.
Project: 57 miles of 36-in. main line loop.
Status: Pending FPC approval. Planned for 1959.
Project: 87 miles of 24-in. laterals, plus small gathering lines connecting seven Louisiana fields with the New Orleans area.
Status: Pending FPC approval.

- **Transwestern Pipe Line Co.** (Warren Petroleum, Monterey Oil Co.; J. R. Butler).

Project: A line from W. Tex. area to Calif. border.
Status: Proposed.

- **United Gas Pipe Line Co.**

Project: 18 miles of 12-in. from Lirette-Mobile line in Jackson County, south to Bayou Casottee industrial area east of Pascagoula, Miss.
Status: Approved.
Project: 202 miles of 30-in. loop from southeast Louisiana, to Mobile, Ala.
Status: Pending FPC approval.

Canadian Crude-Oil Pipelines

- **Act Oils, Ltd.**

Project: A 450-mile line from the Peace River region of northern B. C. to tidewater at Bella Coola, B. C.
Status: Request has been made for permit from the B. C. government.

- **B-A Alberta Pipe Line, Ltd.**

Project: 35 miles of 8-in. to connect Drumheller field, Alberta, with existing lines running to Edmonton.
Status: Pending approval.

- **Bituminous Oil Pipeline Co.** (Royalite Oil Co. and Can-Amera Oilsands Development, Ltd.)

GALVOMAG ANODES USED TO PROTECT 300-MILE LINE

This pipe line company had an old, bare, 8-inch product line that ran 300 miles across three states. The increasing number of corrosion leaks made it imperative to take corrective measures. CSI was awarded a cathodic protection contract on a competitive bid basis.

CSI engineers made soil resistivity tests, determined the size of anodes to use, and staked the anode locations. Then CSI's experienced crews installed 2300 Galvomags, the high-potential magnesium anodes developed by The Dow Chemical Company. CSI also furnished all other necessary materials and equipment, including augers and ditchers.

The job was done to the complete satisfaction of the pipe line inspectors.

You, too, will find it pays to call our stockholder employees—for engineering consultation, installation services, and quality cathodic protection supplies. Estimates or quotations without obligation. Call or write today.

CSI

CORROSION SERVICES INCORPORATED
Tulsa, Oklahoma

P. O. Box 7343, Dept. J-4 Telephone: Circle 5-1351

PIPELINE CONSTRUCTION

Project: 250-mile line from Athabasca oil sands in northeastern Alta., to Edmonton.
Status: Long-range plans.
Completion: 1960.

- **East Coast Transmission Co.** (Pacific Petroleums, Ltd., Home Oil, Ltd., Canadian Homestead Oil, Ltd., Merrill Petroleums, Ltd.)

Project: Line from Alberta to Montreal.
Status: Proposed.

- **Gibson Petroleum Co., Ltd.**

Project: 25 miles of line from Willesden Green field to near Rimbley, Alta.
Status: Has Alberta Government approval.

- **Interprovincial Pipe Line Co.**

Project: 82 miles of 24-in. loops in Alta. and Sask.
Status: Planned.

- **Westcoast Transmission Co., Ltd.**

Project: Line to parallel its 650-mile, 30-in. gas line from Peace River to Vancouver, B. C.
Status: Under study.

- **Westspur Pipe Line Co.**

Project: 20 miles of 12-in. from Alida in southeastern Saskatchewan, to the Carnduff-Glen Ewen area to tap Cantal, Hastings, Florence, Carnduff, and Glen-Ewen fields; 34 miles of 4, 6, 8-in. gathering lines.
Status: Has requested permit from Board of Transport Commissioners.
Contractor: **Majestic Contractors, Ltd.**, Jeff Minter, supt., office in Estevan, Sask.
Completion: No date set.

Canadian Products Pipelines

- **Hydrocarbons Pipeline Co.**

Project: 800 miles of 6 and 8-in. L.P.G. line from near Edmonton, Alta., to Fort William, Ont.
Status: Has permit from Parliament of Canada. Seeking approval by Federal Board of Transport Commissioners and the Alberta Petroleum and Natural Gas Conservation Board.
Construction consultants: **Dutton-Williams Brothers, Ltd.**, and **A. D. Little Co.**

Canadian Natural-Gas Pipelines

- **Alberta Gas Trunk Line Co., Ltd.**

Project: 637 miles of 34 to 16-in. gathering lines in Alberta.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.**, has preliminary studies, design and management-engineering. **Universal Pipe Line, Ltd.**, subsidiary of Mannix, Ltd., jointly with **Marine Pipeline & Dredging Co.**, has crossing of Red Deer River near Cavendish, Alta., J. Hysuick, spread superintendent, office at Empress. **Fulton Banister, Ltd.**, has completed 17 miles of 34-in. west from Burstall, Sask., to near Cavendish, Alta., and 100 miles of 18-in. north to Bindless and Provost fields.

- **Alberta & Southern Transmission Co., Ltd.**

Project: 1,300 miles of 36-in. from Alberta to San Francisco area plus 47 miles of gathering lines.
Status: Planned
Completion: 1960.

- **Canadian Western Natural Gas Co., Ltd.**

Project: 58 miles of 16-in. from Carbon field to Calgary, Alta.
Status: Proposed. Pending approval of Alberta Oil and Gas Conservation Board.

- **Northern Ontario Pipe Line Crown Corp.**

Project: 675 miles of 30-in. from the Ontario-Manitoba border to near Kapuskasing, Ont. (part of the 2,250-mile Trans-Canada line; will be leased to Trans-Canada Pipe Line Co. with option to buy). 360 miles from Port Arthur to Kapuskasing remains to be laid in 1958.
Status: Under way.
Contractor: **Nelen, Ltd.; Majestic Contractors, Ltd.; B. C. River Construction, Ltd.**, has 91 miles from Longlac to Hurst, E. L. Maggard, supt., office at Longlac, to complete October 1; **Mannix, Ltd.; and Morrison Shivers, Ltd.**
Completion: November 1958.

- **Northwestern Utilities, Ltd.**

Project: 72 miles of 16-in. from Pembina field to Edmonton, Alta.
Status: Approved. Planned for 1958.
Completion: 1958.

- **Trans-Canada Pipe Lines, Ltd.**

Project: 491 miles of 30-in. from Kapuskasing to Toronto.
Contractors: Starting at Kapuskasing and going toward Toronto, **Grayco Contractors, Inc.**, has 82 miles; **Majestic Contractors, Ltd.**, has 83 miles; **Dutton-Williams Brothers, Ltd.**, has 57 miles; **Canadian Bechtel, Ltd.**, has 47 miles from Rib Lake to Tilden Lake, H. F. (Hank) Mogg, general supt., office at Timagami; **Morrison-Shivers, Ltd.**, has 62 miles; **H. C. Price Co.** and **Poole Construction Co.** has 63 miles; **Oklahoma Pipe Line Constructors** has 92 miles.
Completion: October 1, 1958.

- **Westcoast Transmission Co., Ltd.**

Project: 42 miles of 20-in. and 100 miles of 30 in. from Savanna Creek area, Alta., to Canadian-Idaho border.
Status: Planned.
Completion: November 1, 1958.
Project: Looping of present system to double capacity.
Status: Planned.
Project: 80 miles of 8, 10, 12, 18, 20-in. extension of gathering system along Alaska Highway in Northeastern B. C.
Status: Under way.
Contractor: **Dutton-Williams Brothers, Ltd.**, Doyle Cook, asst. supt., office at Dawson Creek.
Completion: August 1958.

Foreign Crude-Oil Pipelines

- **Arabian American Oil Co.**

Project: 9 miles of 32-in. loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1960.
Project: 17 miles of 32-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1961.
Project: 9 miles of 30-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1960.
Project: 12 miles of 30-in. extension of loop from Abqaiq toward Shedgum.
Status: Planned.
Completion: 1961.
Project: 54 miles of 30-in. loop of Safaniya-Ras Tanura line.
Status: Planned.
Completion: January 1959.
Project: 63 miles of 30 and 32-in. from Khursaniyah to Ras Tanura.
Status: Planned.
Completion: January 1960.

- **Assam Oil Co.**

Project: 600 miles of 20-in. from Nahorkatiya field in Upper Assam to Barauni, India, to connect with **Burmah Oil Co.'s** proposed 250-mile line from Barauni to Calcutta.
Status: Survey of possible routes under way.
Contractor: **Pipe Line Engineering Co.** is making survey.

- **Bolivia-Paraguay.**

Project: 500 miles of 6-in. from Southeast Bolivia to a proposed refinery on Paraguay River, and later to Asuncion.
Status: Planned .
Contractor: **Five Lilles**, a French Combine.

- **Burmah Oil Co., Ltd.**

Project: 250 miles of 20-in. from Barauni to Calcutta, India, extending Assam Oil Co.'s proposed line.
Status: Survey under way.
Contractor: **Collins Construction Co.** is surveying locations for some 40 river crossings.

- **Caltex**

Project: 30 miles of 30-in. from Duri field in Sumatra to Dumai where a deepwater terminal will be built. Line will be extended 35 miles to Minas field later.
Status: Under way.
Contractor: **Bechtel Corp.**
Completion: May 1958.

- **Cia. Shell de Venezuela**

Project: 34 miles of 16-in. from Boscan to site of a planned terminal at Puerto Miranda, Venezuela.
Status: Planned.
Contractor: **Williams Brothers Sudamericano, Ltd.**

- **Colombian Petroleum Co.**

Project: 42 miles of 6-in. from Tibu field to Rio de Oro in Colombia.
Status: Under way.

- **C.R.E.P.S., Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SN Repal), and Cie. Francaise des Petroles Algerie**

Project: 450 miles of 16-in. from Edjele field in southeastern Algeria to a Mediterranean port on the Libyan coast.
Status: Pipe has been ordered.

- **Creole Petroleum Corp.**

Project: 100 miles of 30-in. from Temblador field to Caripito in Venezuela.
Status:Under way.
Contractor: **Pipe Line Engineering Co.** and **Oklahoma Pipe Line Constructors**, R. J. O'Connell, supt., office at Maturin.
Completion: April 30, 1958.

- **Elburz Oil Corp.**

Project: 1,000 miles of 38-in. to move Qum crude to the Mediterranean.
Status: Planned.

- **Iranian Oil Participants, Ltd.**

Project: 30 miles of 20-in. and 22 miles of 16-in. looping of Agha Jari to Bandar Mashur line.
Status: Planned.
Project: 50 miles of 26, 28-in. from Gach Saran field to new terminal at Kharg Island in the Persian Gulf.
Status: Planned.
Contractor: A joint venture of **Raymond Concrete Pile Co.** and **Williams Brothers Co.** of Tulsa; **Richard Costain, Ltd.**, and **John Brown, Ltd.**, of Britain; **Werkspoor & Bredoro** of The Netherlands.

- **Iraq Petroleum Co.**

Project: About 600 miles of up to 40-in. from Kirkuk field through Iraq to Turkish port of Iskenderun on the Mediterranean.
Status: Proposed. Survey completed.

- **Mene Grande Oil Co.**

Project: 97 miles of 30-in. from fields in Eastern Venezuela to Puerto La Cruz.
Status: Under way.
Contractor: **Fulghum Contracting Corp.** has 22 miles between Oficina and Anaco. **Williams Brothers Co.** has remainder.
Completion: First quarter 1958.
Project: 45 miles of 24-in. from Oficina to Melones, Venezuela.
Status: Planned.
Completion: First quarter 1958.

- **Middle East Pipeline**

Project: 1,500 miles of 38 and 40-in. line from Persian Gulf to Mediterranean at Iskenderun, Turkey.
Status: Proposed.

- **North-West Oil Pipeline Co.** (newly formed by six West German refiners, headed by affiliates of Standard Oil Co. (N.J.), and British Petroleum Co., Ltd.)

PIPELINE CONSTRUCTION

Project: 230 miles of 28-in. from refining centers in the industrial Ruhr area of West Germany to Wilhelmshaven.
Status: Work to start early 1958.
Contractor: **W. M. Lyles** in joint venture with two German steel firms.
Completion: November 1958.

- **Royal Dutch-Shell**

Project: 700-mile line across Europe from the Mediterranean to the North Sea, running through Eastern France, Luxembourg, West Germany, Netherlands, and Belgium. Main trunk to be 30-in.
Status: Company is considering project together with several other companies.

- **SOPEG** (Cie. Francaise de Petrole (Algerie) and Ste. Nationale de Recherche et d'Exploitation des Petroles en Algerie)

Project: 300 miles of 24-in. from Hassi Messaoud field in the Algerian Desert to Bougie on the Mediterranean Coast.
Status: To start fall 1958.
Contractor: **Entrepose Co.** jointly with **Ste. Parisienne pour Industrie Electrique.**
Completion: 1959.

- **Union of Soviet Socialist Republic**

Project: 2,300-mile Trans-Siberian crude-products line from Ufa Tuimaza fields in Bashkiria to Irkutsk near Lake Balkal.

- **Yacimientos Petroliferos Fiscales** (Argentina)

Project: 932 miles of 12-in. from Campo Duran to San Lorenzo.
Status: Planned.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.)
Project: 625 miles of 12-in. from Mendoza to San Lorenzo.
Status: To start 1st quarter 1958.
Completion: Mid-1960.
Project: 390 miles of 14-in. from fields in Neuquen Province, Argentina, to Bahia Blanca on the coast.
Status: Bids requested.

- **Yacimientos Petroliferos Fiscales Bolivianos**

Project: 174 miles of 10-in. and 44 miles of 8-in. from Sicasica, Bolivia, to Arica, Chile.
Status: Planned.
Contractor: **Williams Brothers Co.** and **Telescopic Pipe Line.**
Completion: October 1958.

Foreign Products Pipelines

- **Empresa Nacional de Petroles** Government of Chile and Cia de Petroles de-Chile (Copec), et al.

Project: 75 miles of 10-in. from Chile's coastal refinery at Concon to Santiago.
Status: Under way.
Contractor: **Williams Brothers.**
Completion: 1958.

- **National Iranian Oil Co.**

Project: 90 miles of 12-in. from Abadan to Ahwaz, Iran.
Status: To start spring 1958.
Contractor: **Entrepose Co.,** Paris.
Completion: Summer 1958.

- **North Atlantic Treaty Organization**

Project: 2,000 miles of lines to airfields in parts of Europe.
Status: Under way.
Contractor: **Associated Pipeline Contractors, Inc.** (450 miles from Iskenderun, Turkey, to Batman); **TECHINT** (205 miles of 4-in. from Bandirma to Eskisehir, Turkey, and 250 miles of 8-in. from Antalya to Eskisehir).

Foreign Natural-Gas Pipelines

- **Attock Oil Co.**

Project: 60 miles of line from Dhulian field to Rawalpindi in West Pakistan.
Status: Planned.

- **City of Riyadh, Saudi Arabia**

Project: 182 miles of 10-in. from Ghawar field to Riyadh.
Status: Planned.

- **Cuban Gas Transmission Co.**

Project: 650-mile pipeline from Campeche area of Mexico across Yucatan and on the ocean floor to Havana, Cuba; 150 miles would be submarine.
Status: Being studied by Ebasco Services.

- **Gaz de France**

Project: 550 miles of 16 to 24-in. from Lacq field, southwestern France, to Paris, plus a 10-in. terminal to Nantes and 12 to 16-in. laterals to Lyons, making a 1,000-mile system.
Status: Under way.
Contractor: French contractors.
Completion: First stage in 1958; complete system in 1960.

- **NIOGAS**

Project: 160 miles of 6, 8, 10, and 12-in. from Fischamend field to Vienna and other Austrian cities.
Status: Under way.
Contractor: **Williams Brothers Co.** and **Costain-John Brown, Ltd.**
Completion: Fall 1958.

- **North Thames Gas Board**

Project: Will extend its Shellhaven-to-Romford line to Coryton then to Canvey Island.
Status: Planned.
Completion: Summer 1958.

- **Petroleos Mexicanos.**

Project: 130 miles of 22-in. to parallel a 14-in. line from Reynosa to Monterrey.

- **Sui Gas Transmission Co.**

Project: 310 miles of 16-in. from Sui gas field to Moultan, Pakistan.
Status: Under way; to be extended later to Lahore with branches at Kot Addu, Jhang, Magiana, and Montgomery.
Contractors: **Pakistan Constructors,** a joint company of **Morrison-Knudsen** of Boise, Idaho, and **William Press, Ltd.,** of London.
Project: 145-mile line from Sylhet to Dacca, East Pakistan.
Status: Under consideration. If approved construction could start December 1958.

- **Technical Office of Hydrocarbon, Ministry of Mines and Petroleum, Government of Venzuela.**

Project: 207 miles of 26-in. from Anaco fields to Caracas.
Status: Under way.
Contractor: **Williams Brothers Co.** has part.
Completion: Spring 1959.

- **Union of Soviet Socialist Republic.**

Project: 808 miles of 26-in. from Stavropol in the Northern Caucasus to Moscow, to serve Voroshilovgrad, Voronezh, Tula, Yelets, and Serpukhov.

- **Yacimientos Petroliferos Fiscales** (Argentina)

Project: 1,015 miles of 24-in. from Camp Duran to Buenos Aires.
Status: To start first quarter 1958.
Contractor: **TIPSA** (Fish Engineering Corp., Fish Northwest Constructors, Inc., Clark Brothers, North American Utility, Construction International Co.)
Completion: Mid-1960.

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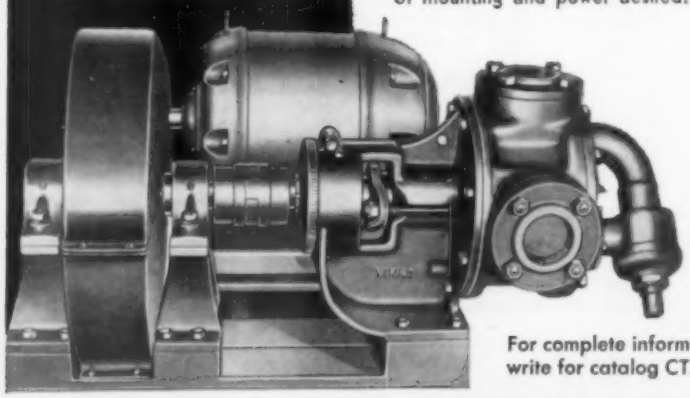

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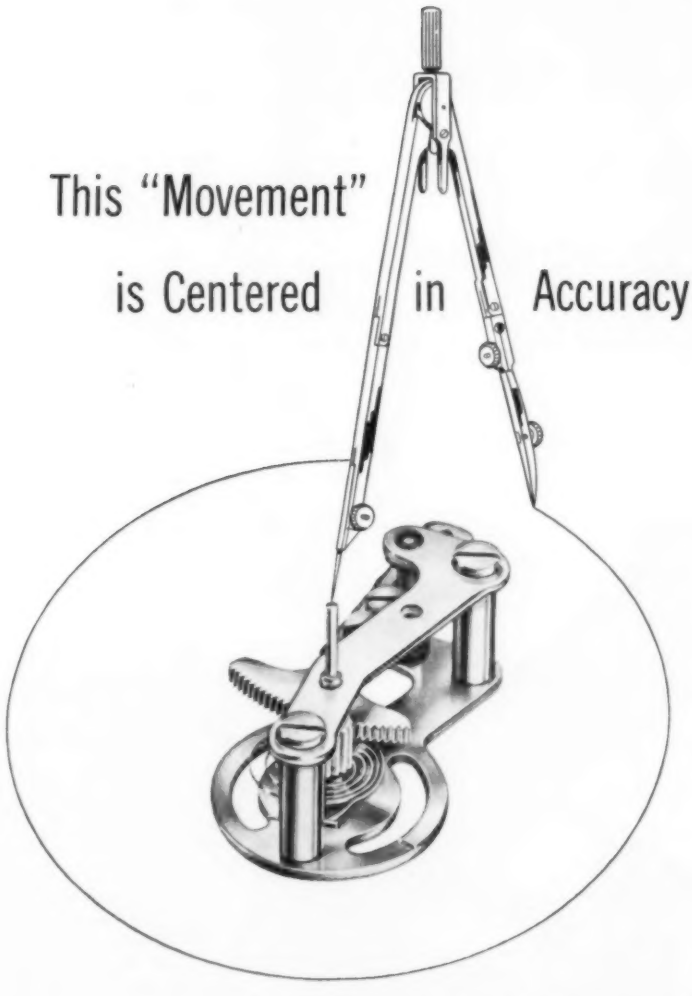

The rotary movement in Ashcroft Duragauges has a geared center shaft on which the pointer is mounted. When pressure flexes the Bourdon tube, the pointer is always positively positioned. You can rely on the Duragauge for precise accuracy in measuring pressure no matter how severe the conditions of service.

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You can order Ashcroft Duragauges with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. A complete choice of Bourdon tube materials, pressure ranges, dial sizes and case designs and materials is available. Your industrial supply distributor will gladly help you select the best combination for your requirements. So, be certain of highest sustained accuracy, durability and economy – specify Ashcroft Duragauges.

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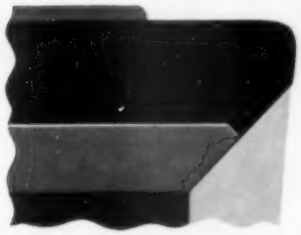
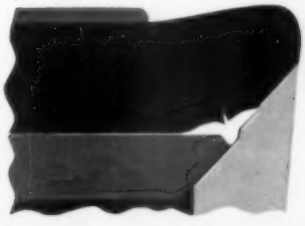


Conventional valves use a sealing element that seals at an angle, usually in the same plane with at least part of the striking surface. This arrangement works well when the valve is new and when pump pressures are low.



With wear, however, an opening forms at the junction of valve body, seat and sealing element. High pump pressures force part of the rubber sealing element into this space and it is pinched off. The result is short life for both sealing element and valve.

MISSION MUD MONARCH

NEW

With Mud Monarch Valves, the valve body strikes against the entire inclined surface of the valve seat, and the near-vertical seal ring seals against the outside diameter of the valve body. With this design, seal ring life is independent of valve and seat wear.

WORN

With wear, the entire inclined striking surface of the seat is worn away. An opening can't form next to the seal ring. Both valve and seat wear longer before they need be replaced and seal ring life is increased substantially—

HERE'S WHY MUD MONARCH VALVES LAST LONGER THAN CONVENTIONAL VALVES UNDER JET DRILLING CONDITIONS

Most slush pump valves do a good job when they are new, but when valve body and seat become worn, an opening forms between seat and body next to the sealing element that plays havoc with valve life. This condition exists, to a certain degree, with all valves except the Mud Monarch. By preventing the formation of this opening, Mission Engineers have developed a valve that gives truly outstanding service – especially in high pressure jet drilling where most valves fail rapidly. If you are dissatisfied with the service you are getting from slush pump valves, try the Mission Mud Monarch. You will discover a new high in valve performance and a new low in valve costs. Like all Mission Products, Mud Monarch valves are guaranteed to give outstanding service or your money is refunded. You can't lose, so try them right away. They are made in sizes to fit most pumps and are available through all supply stores.

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Among the Drilling Contractors

Three Rigs Get Work in New Little Creek Field

The recently discovered Little Creek field, in southern Mississippi, already has given work to three heavy-duty rigs in addition to the one used in drilling the discovery well.

The field, productive from Tuscaloosa sand below 10,750 ft., was opened late in January by Shell Oil Co. Its discovery well, 1 Lemann, is 15 miles southeast of Brookhaven, in southern Lincoln County, near the Pike County line.

Shell's discovery well was drilled by Marshall R. Young, of Brookhaven. Since its completion, Reading & Bates, Inc., Tulsa-headquartered contractor; Drilling & Exploration Co., Dallas; and Dorris Ballew, Natchez, Miss., have moved in heavy rigs.

The first two contractors are drilling for Shell. Ballew, who has been an active contractor, as well as an operator, in southern Mississippi, is drilling for his own account.

Reading & Bates' operation is about ¾ mile south of the discovery well across the county line in Pike County. Drilling & Exploration is on a south offset to the discovery. Ballew is drilling a southwest offset.

Young's rig used on the discovery well is not active in the field at present. Young, however, has rigs on five other Lincoln County operations at this time. Two are in the deep Sweetwater field, just 1 mile north of the new Little Creek field, where Young is contracting for Shell and H. L. Hawkins. He is drilling for California Co. at Mallalieu, southeast of Brookhaven field, northwest of town. The fifth rig is a wildcat test Young is drilling for his own account northeast of Brookhaven.

Little Creek field, judging from the productivity of the discovery well, is regarded as an important Mississippi discovery, and may provide drilling for more rigs. All drilling is to 11,000-ft. depths.

Vick Drilling Co. has a rig running on a wildcat location 6 miles northeast of Centerville, in Leon County, East Texas. It is a 7,000-ft. Rodessa test for W. C. Perryman, of Athens, Tex. Location is listed as 1 Burleson with spot in the Thomas Sales Survey.

Longhorn Drilling Corp., Three Rivers, Tex., is drilling a significant deep test in the old Doering Ranch area, 14 miles northwest of Dilley, in

TIME OUT on the drilling barge Crown Rigs, Inc., Houston contractor, is operating on an ultra-deep wildcat test for Sunray Mid-Continent Oil Co. in Vermilion Bay, 15 miles south of Abbeville, in Vermilion Parish, Louisiana. Kneeling, left to right: Wilton Bourque, cook; A. W. Richardson, tool pusher; C. C. Stinnett, drilling superintendent; and William Picard, boat captain. Back row, same order: T. J. Belanger, driller; O. D. Belanger, engineman; Lee Hebert, derrickman; Parson Bodin, and O. A. Thibodeaux, floormen. The wildcat, drilled to 17,000 ft., now is testing indicated gas-condensate production in sand at 13,891-95 ft.

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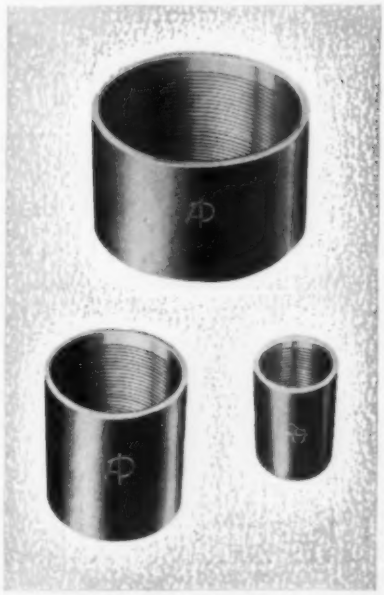

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southwestern Frio County, Southwest Texas. It is a contract operation for Katz Oil Co. and Lone Star Producing Co., who plan to take the hole to the Lower Cretaceous-Hosston formation below 10,500 ft. Production in the area has been from Navarro sand, at 4,100 ft., and Austin chalk, at 5,500 ft., in the Upper Cretaceous section.

Pool & Gerlich Drilling Co., San Angelo, Tex., is working on a rank wildcat location in Bandera County, in the "hill" country northwest of San Antonio, Southwest Texas. It is drilling for G. L. Rowsey with plans to go to 7,000 ft. Location is northwest of Bandera, in the eastern part of the county.

Woolf & Magee, Inc., Tyler, Tex., has a rig working for Serio-Punches Oil Co., of Natchez, Miss., on a 6,500-ft. Wilcox test at a wildcat location north of Flat Rock field, in Franklin County, southwestern Mississippi. Location is at 1 Anderson, in 26-5n-1e.

Halbert Drilling Co., Tyler, Tex., is associated with E. C. Casey, also of Tyler, as contractor and joint operator in a wildcat operation 3 miles northwest of Whitehouse, in southern Smith County, East Texas. It is a 6,200-ft. Woodbine test at 1 Skidmore, in the Drury Smith Survey.

Mobile Drilling Co. is getting under way on Four W. Oil Co.'s third well in the new South Streetman field, in northwestern Freestone County, East Texas. The new operation, 1 Whatley, is about 1,200 ft. east of the operator's discovery well, completed last July with oil production from a 6,975-ft. Pettet sand. The second well, completed earlier this month, is north of the discovery well. Permits call for 7,200-ft. drilling.

Johnson Drilling Co., Tyler, Tex., is working on a new wildcat operation in northeastern Houston County, East Texas. It is a 6,500-ft. contract job for W. H. Bryant, also of Tyler, at 1 Bowlin, in the N. Dougherty Survey. It is about 1½ miles northeast of Percilla. Woodbine is the objective.

Parker Drilling Co., Tulsa, has contracted for a deep test to be drilled for Felmont Oil Corp. at a wildcat location 12 miles northwest of Lovington, in Lea County, New Mexico. Permit is for a 14,500-ft. test. Location, on Felmont's Etcheverry Unit, in 5-15s-34e, is about 3 miles east of Saunders field.

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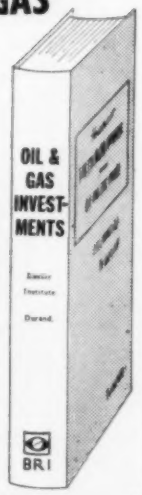

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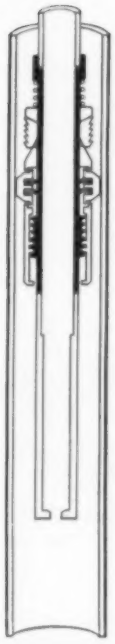
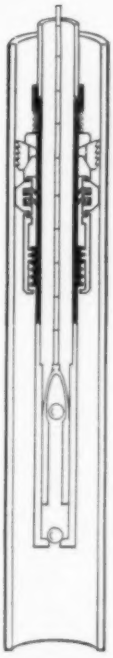
A

Tubing run-in, Anchor not engaged



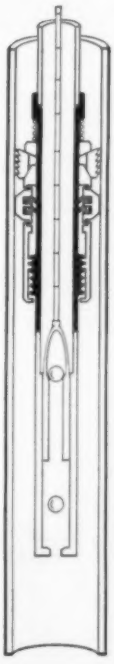
B

Pump in place, Anchor engaged. Tubing stretches with down-stroke of pump. Anchor is moved downward.



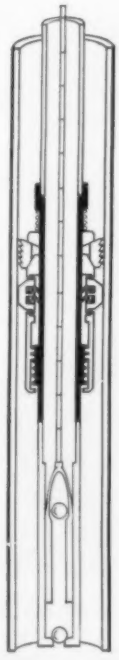
C

Up-stroke does NOT move Anchor or tubing. Succeeding down-strokes move Anchor downward until . . .



D

Maximum elongation due to increasing fluid load has occurred. Tubing is in proper tension to eliminate both breathing and buckling



WHAT DOES COMPENSATING MEAN?

HOW DOES IT WORK?

"COMPENSATING" means that the tubing is allowed to adjust itself to compensate for any changing well condition that requires additional tension in the producing string. The above illustrations show how the Anchor is adjusted downward by one factor (in this case the increasing fluid load in the tubing) causing tubing elongation. Any other factor (temperature rise, annulus decline, etc.) requiring an increase in tubing tension, is automatically compensated for in a similar manner.

In order for a tubing anchor to accomplish complete elimination of both breathing and buckling, it is necessary for it to be so designed and constructed that it will continually catch and maintain the tubing at the lowermost point in its downward travel during each adjustment. Only in this manner can the exact amount of tension required be kept in the tubing string at all times . . . and only Baker Compensating Anchors have this feature, as illustrated in the drawings below.

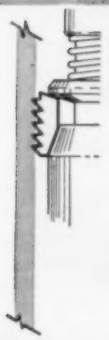


Fig. E

Slips of Anchor engaged in I.D. of casing, maintaining tension in tubing.

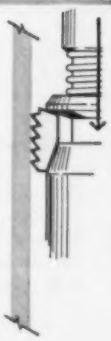


Fig. F

As tubing elongates, Slips momentarily disengage sufficiently to allow tubing to move downward.

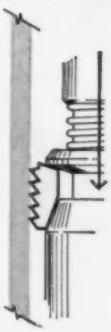


Fig. G

Anchor being moved down casing by tubing elongation. Note that Follow-Up Spring maintains contact between Cone and Slips, keeping Slips against casing so that . . .

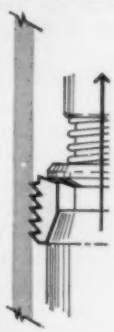


Fig. H

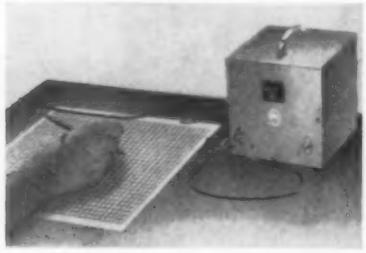
When tubing tries to reverse its direction and move upward, Slips are **immediately re-engaged,** maintaining proper tension—eliminating gouging, hammering.

SHOWCASE...

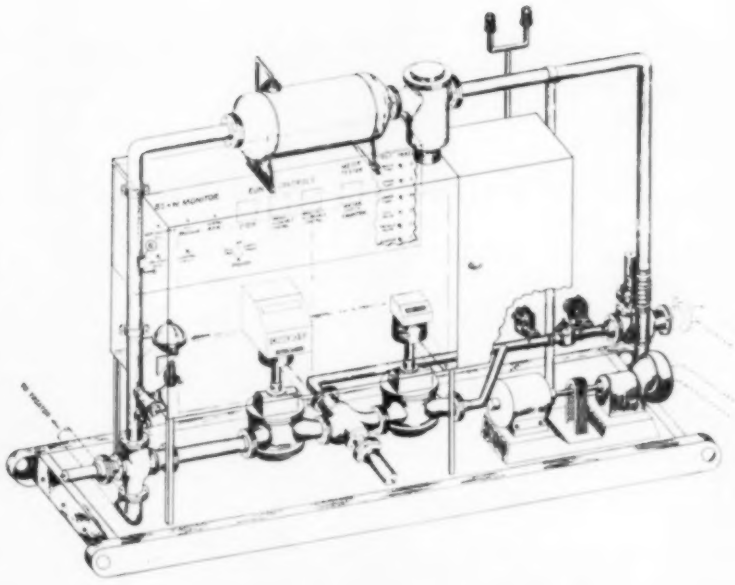
NEW EQUIPMENT

Calculator Speeds Map-Area Measurement

The electrical instrument can be used for determining the number of square inches in given areas on maps, aerial photos, and drawings. Calibration of the machine is in 100ths of a square inch. But different calibrations can be substituted.



The number of square feet, acres, square miles, etc., in a specified area can be determined by use of conversion factors. The area calculator is highly accurate—99 per cent—and rapid, the maker reports. **Write or call: Martin-Kuykendall Co., 1002 Fourth Street, Northwest, Albuquerque, for details on area calculator.**



LACT Unit Operates Automatically

Designed to test, measure, and control oil runs, and called an automatic custody-transfer meter, this new unit is a packaged, skid-mounted type. According to the maker, it can eliminate the conventional tank battery, reduce pumper labor, and minimize evaporation and gravity losses. The unit is designed to eliminate human errors in gaging, spillovers, and reduce the required number of run tickets, thus cutting clerical labor costs.

Features of the unit include: (1) daily proving of the production meter by a check meter, (2) automatic shutdown if meter error exceeds a predetermined amount, (3) visual alarms to indicate when the meter requires proving, and (4) a factory-assembled, prewired, packaged prover flume.

The prover flume eliminates the need for a special prover tank to calibrate the automatic custody-transfer meters. It provides a simple and accurate method for proving meters by regular operating personnel.

The prover flume incorporates a factory-installed ground-level tank gage that eliminates field installation and expense. **Write or call: Major Engineering Co., 9 West Easton, Tulsa, for details on Meter Automatic Custody Transfer unit.**

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of **March 3, 1958**

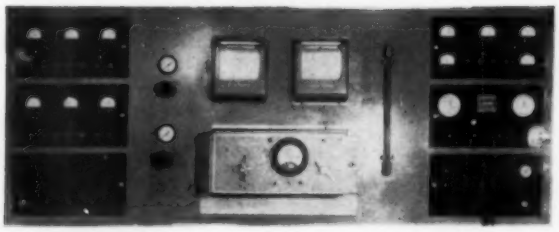
NAME.....TITLE.....

COMPANY.....

ADDRESS.....

CITY.....STATE.....

DATE.....



Gas Analyzer Tests Samples at Well

Well-site analysis of gas samples with the analyzer is now offered at no extra cost as part of Hycalog's regular well-logging and gas-recording services. The analyzer has a sensitivity many times greater than conventional gas detectors, according to the company.

Trade-named Gas Chronofrac, the instrument chronologically fractionates samples taken at measured intervals directly from the flow line.

The unit is a two-phase elution system. It employs a hydrogen-methane monitor and a component analyzer. These normally operate in the range of C-1 to C-4 hydrocarbons.

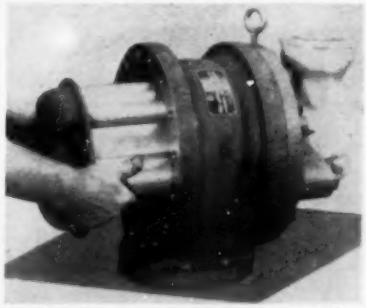
In the first phase, a continuously repetitive analysis, on 1-minute cycles, provides alternate readings on a barograph of both hydrogen and methane. The separation of hydrogen and methane prevents false shows due to hydrogen produced by some types of mud conditions.

As soon as a methane show is recorded, samples are automatically fed into the second phase. There a component analysis is run and recorded on a chronological type graph.

Immediate on-location logs are available, within 2 minutes after a sample is introduced into the unit. This information is later incorporated into the complete logging report on the well. **Write or call: Hycalog, Inc., 505 Aero Drive, Shreveport, La., for details on Gas Chronofrac analysis.**

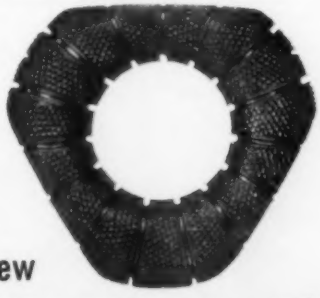
Meter Conversion Kit Can Up Capacity

This new crank-control conversion kit was developed for old-model Rockwell Rotocycle liquid meters. It consists of a new crank-controlled-rotor measuring assembly.



Advantages claimed for the linkage-controlled assembly include: (1) 20 per cent greater measurement capacity, (2) greater life expectancy, (3) quiet operation, (4) permanent timing (eliminating retiming effort and cost), and (5) fewer moving parts (reducing maintenance costs.) **Write or call: Meter & Valve Div., Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, for Bulletin OG-641.**

announcing . . .



the all-new

D&S TRI-DIA Core Bit!

Check these outstanding features:

- Designed for safety.
- Reduced OD wall contact, similar to Tri-Cone Rock Bit.
- Reduces mud wall cake sticking hazard.
- When making trip, eliminates swabbing – hydraulic action.
- Minimizes junk iron hazard – allows washing out large pieces.
- Readily washes out cavings to bottom.
- Largest measurable diameter materially less than diameter of hole it will cut. (Special Bit Breaker required.)

WRITE OR CALL TODAY! One of the D & S sales engineers will call on you to show tremendous TRI-DIA Bit and Core Barrel advantages.

Drilling & Service INC. | DIAMOND DRILLING EQUIPMENT
6210 NORTH CENTRAL EXPRESSWAY | DALLAS, TEXAS
OFFICES IN ALL PRINCIPAL OIL AREAS

"I tell you I am lifting!"

All-Electric Deck Crane Lifts 25 Tons

Suited for installation aboard marine crafts and on docks or other locations where constant lifting is required within a prescribed area, the crane features powered down-travel.

Lowering speed is automatically regulated by a regenerative electric brake. The electro mechanical brake sets mechanically and releases electrically, causing the load to remain in one place the instant the control switch is released. Starting the motor automatically releases the brake. If power fails, the load is held safely in one place until power is restored.

According to the maker, low maintenance is a feature of the crane. This is said to be due primarily to the fact that the motors and gears are located directly at all work points, eliminating mechanical drive, torque converters, and a transmission system. The maker's standard crane uses an a.c. motor for its swing drive. But a d.c. motor is optional for more precise handling of heavy materials.

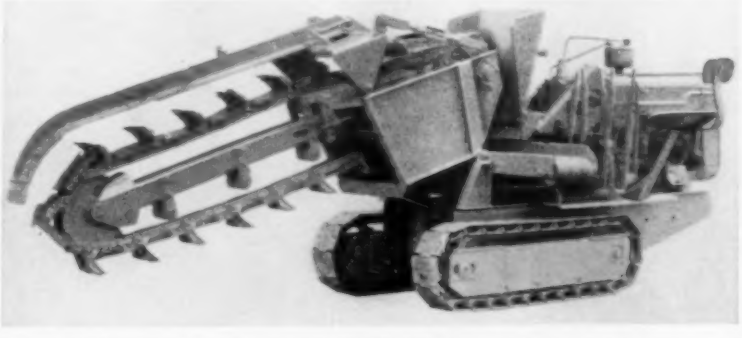
The crane carries a rating of 300 ft.-tons. This rating indicates the crane will lift 25 tons at a minimum boom radius of 12 ft. Boom lengths range up to 80 ft. **Write or call: R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex., for details on electric deck crane.**

●

Portable Drill Built For Blast Holes

The new Portadrill, Model 105TA, is designed for blast- hole and exploratory drilling in all stratas, including hard rock, the maker reports. The drill mounts on an Eimco 105 diesel tractor, 125-143 hp. Two rotary-vane compressors furnish 1 M.c.f per minute of air to remove cuttings from the hole at pressures from 15 to 17 psi. Pressure up to 50 psi. is available for cleaning the hole in wet or sticky substances.

The compressors may be used singly or together—depending on the volume of air needed to keep the hole clean. Cuttings are controlled at the top of the hole by a deflector hood and water-spray system which protects both the crew and equipment from dust and cuttings. A cuttings-collection system is also available for exploration or sampling work. The mast is raised and lowered hydraulically. **Write or call: Portadrill Div., Winter-Weiss Co., 2201 Blake Street, Denver 5, for details on Portadrill.**



Trencher Features Self-Cleaning Line

Measurements on the new Model 77 Parsons trencher include a 5 ft., 10 in. roading height, 5 ft. 5 in. digging height, 4-ft. width, and a total transporting weight of only 6,750 lb. Its digging range goes to 5-ft. depth at 6 to 18-in. widths. Sixteen digging feeds—4.4 to 181 in. per minute—are available. Optical sprocket feeds also total 16, ranging from 6.2 to 252 in. per minute.

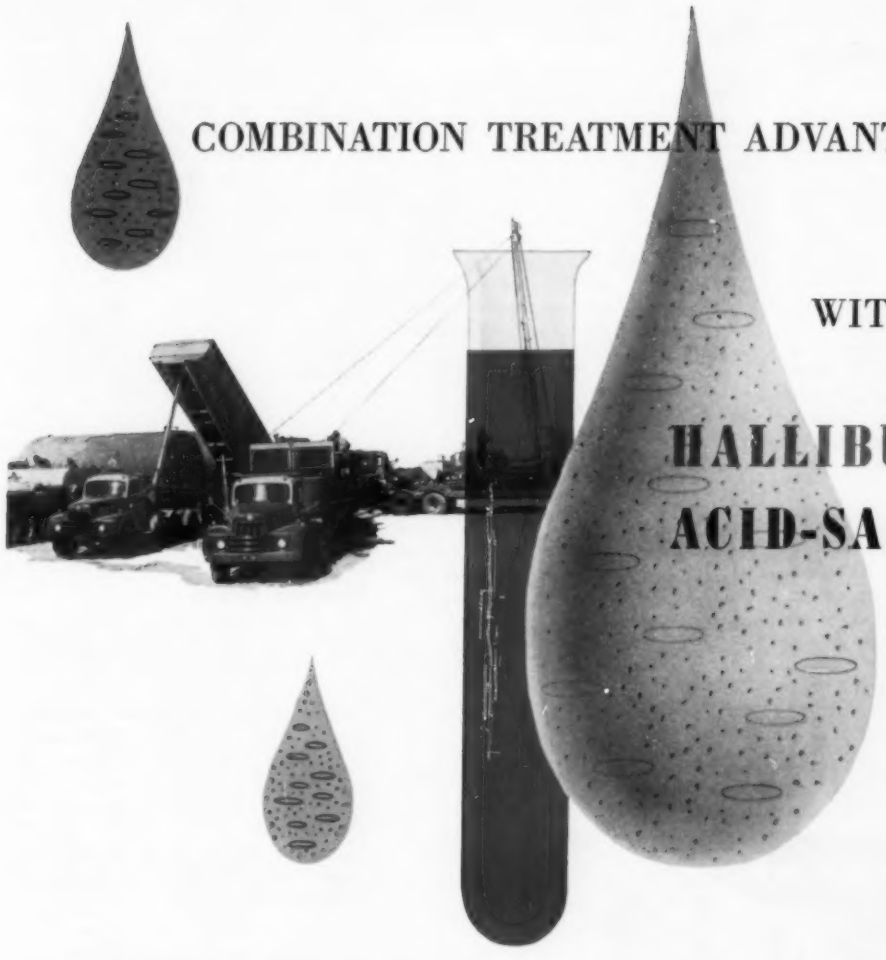
Four bucket-line speeds are available. These range from 38.5 to 246 ft. per minute. The four conveyer-belt speeds range from 75 to 480 ft. per minute. The conveyer is shiftable and reversible. Spoil can be deposited on either side of the trench. The boom is a telescopic type for depth variation.

Each crawler is independently driven and braked. The trencher can turn in its own length. Forward speeds are: 0.375, 0.778, 1.42, and 2.41 m.p.h. Reverse speed is 0.307 m.p.h. **Write or call: Parsons Co., Newton, Iowa, for complete details on Model 77 trencher.**

COMBINATION TREATMENT ADVANTAGE

WITH

HALLIBURTON'S ACID-SANDOIL



Acid-Sandoil, a combination type treatment, was developed for more satisfactory results in certain formations where both acidizing and fracturing methods alone have not proven profitable.

Before the Acid-Sandoil fracturing treatment is applied, a careful analysis of well conditions, as presented by the operator, is made to determine the combination of components required. Field Laboratory tests can aid the well owner in determining the amount and kind of non-emulsifying agent most suitable to meet well requirements.

Successful fracturing has been accomplished by pumping both acid and sand-laden oil simultaneously in selected proportions down the casing... or by pumping acid through tubing and the fracturing oil through the annulus. Excellent results have been obtained with both procedures. The non-emulsifying agents and dissolving power of acid, combined with fracture extension, all work together to create new permeability and to reduce flow restrictions... for more production.

Keep Acid-Sandoil in mind for your wells. Check with your Halliburton Fracturing Specialist.

For more information about all Halliburton fracturing techniques, ask for your free copy of the NEW bulletin, "Elements of Hydraulic Fracturing."

HALLIBURTON FRACTURING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY, DUNCAN, OKLAHOMA

THE PIONEER IN FRACTURING SERVICES

SHOWCASE . . .

New Literature

Automation Controls . . .

is a new catalog that groups together a wide selection of automatic controls most commonly used in designing automatic systems. Included are such items as counting devices, switches, and electric valves. Also listed are actuators, relays, limit controls, time switches, and a host of accessory equipment which the engineer can use as building blocks in selecting the components for tailoring an automated system. **Write or call: General Controls Co., 801 Allen Avenue, Glendale 1, Calif., for Automation Controls bulletin.**

Atmospheric coolers . . .

of the horizontal-core type are reviewed in new Catalog 557. This catalog contains important facts on design features, performance and specification data, and accessory equipment. Dimensions, nozzle-selection diagrams, and other pertinent data contained in the catalog will help determine the proper unit to select to meet specific requirements for cooling and temperature control of oil, water, gases or condensing vapors. **Write or call: Young Radiator Co., Racine, Wisc., for Catalog 557.**

Nitrogen generators . . .

a self-contained packaged type, are described in new Bulletin N-557. The bulletin contains illustrations of typical installations and a description of a new simplified one-station control panel. Charts of the over-all dimensions, weights of all standard sizes, and operating costs are included. **Write or call: Gas Atmospheres, Inc., 20011 West Lake Road, Cleveland, for Bulletin N-557.**

Steel-toe safety shoes . . .

are covered in a new 16-page catalog that lists complete details on 72 different safety-shoe styles for men and women. It includes a buying guide on how to select the best sole and construction for different industrial conditions and hazards. **Write or call: Lehigh Safety Shoe Co., Emmaus, Pa., for Safety Shoe catalog.**

Pipeline machinery . . .

and equipment Catalog PL-57 discusses pumps, compressors, and specialty items used in pipeline service. Quintuplex, triplex, and duplex reciprocating pumps, in-line vertical centrifugal pumps, line siphons, hot-tap valves, and pressure-tap valve assemblies are covered in the 12-page booklet. Specifications and performance data are listed for all items. **Write or call: Oil Well Supply Co., Div. of United States Steel Corp., P. O. Box 478, Dallas, for Catalog PL-57.**

Repeated acid cleaning . . .

effects on boilers, heat exchangers, and process equipment are presented in a new four-page report. Specific instances are cited for cleaning of evaporators, boilers, and condensers by chemical methods. According to the bulletin, a boiler tube showed no wall thinning or significant pittings after 19 chemical cleanings. **Write or call: Dowell Incorporated, P. O. Box 536, Tulsa 1, for Chemical-Cleaning report.**

Pipeline filters . . .

for air and other gases are featured in Bulletin 200. It features specifications, cutaway illustrations, and photographs which show the advantages of models for filtering of air and other gases. The stay-new double-action principle, applications, and advantages are outlined. Simplicity, accessibility, long life, and efficient operation are characteristics of the product, according to the maker. **Write or call: Dollinger Corp., Rochester 3, N. Y., for Bulletin 200.**

Pressure reducing valves . . .

are described in new six-page Bulletin J-160. The valves are designed to give dead-end shutoff on all fluid services. The bulletin describes valve features, design improvements, and method of operation. It contains flow-capacity charts, dimensional drawings, control ranges, and material specifications. **Write or call: Jordan Industrial Sales Div., OPW Corp., 6013 Wiehe Road, Cincinnati 13, Ohio, for Bulletin J-160.**

Transfer valve . . .

the new Cash Standard Type 45, is described by a new bulletin. The valve is designed to provide fast and smooth transfer from one strainer or heat exchanger to another and in other situations where one unit is to be used at a time and quick switch-over to another similar unit is required. The bulletin contains design and performance information on the new valve and lists sizes available. **Write or call: A. W. Cash Co., P. O. Box 551, Decatur, Ill., for Type 45 Duplex Transfer Valve Bulletin.**

FITTED FOR THE JOB

Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER *FIRST* for the finest in steel fabrication.

another MASTERPIECE *fitted for the* JOB

Master also produces API 5LX HI-TEST Expanded Line Pipe

MASTER TANK & WELDING

P. O. BOX 5146 • DALLAS, TEXAS • RI7-2441

It's a departure for Ford as it presents a line of

New heavy-duty trucks

INCLUDED in the new line of tilt cab, conventional, and tandem models are trucks ranging from 25,000 to 51,000 lb. gross vehicle weight and 50,000 to 75,000 lb. gross cargo weight.

J. O. Wright, Ford Motor Co. vice president and Ford Division general manager, said the firm had also inaugurated a new marketing system for the big trucks. "For the first time, Ford dealers have a complete line of trucks to meet virtually all requirements of truck operators," Wright said.

Basis of the new marketing system is 350 specialized Ford dealers who are strategically located throughout the country. They have elected to be primary marketing points for the sale and service of the heavy-duty line. All Ford dealers will sell the complete line of trucks. However, those who have not elected to adopt the plan will purchase heavy-duty models through a specialized dealer for sale to their customers.

Featuring up to 20 per cent greater capacity than previous Ford trucks, the new series includes the F-850, F-950, F-1000, and F-1100 conventional cab models; the C-850, C-950, C-1000, and C-1100 tilt cab models; and the T-850 and T-950 tandems. They are available with a wide range of wheelbases, regular production options, and special equipment.

These big trucks are equipped with three completely new engines, seven heavy-duty transmissions, and 11 heavy-duty rear axles with capacities up to 38,000 lb. With displacements of 401,477 and 534 cu. in., the new V-8 engines develop gross horsepower of 226, 260, and 277 at 7.5 to 1 compression ratios.

Oil pump and cooler are inside the engine, and the oil filter and air compressor are integrally mounted to the block. This eliminates external piping and thus reduces the possibility of oil leaks.

Engine efficiency is improved with a three-stage cooling system. By successively opening the heads and intake manifold, the block, and then the entire system and radiator to circulating water, the engine gets fast warmup and cooling only when and where needed.

The fuel system is new from the fuel pump to carburetor and manifolding.

Submerged in the fuel, the pump is driven by magnetic lines of force from a sealed electric motor. Since the fuel is pushed, instead of pulled, to the carburetor, vapor lock is practically impossible.

Power steering is standard on the T-850 and T-950, and is optional on all F and C models. Full air brakes, powered by an integral air compressor, are standard on all T-950's, and F and C-1000 and 1100 models. A mechanical tachometer is standard on all models.

You can get much more details about these trucks by reading the 24-page Ford ad in this issue.

Williams & Lane, Inc., Is Named By GM Diesel . .

to distribute General Motors two-cycle engines in the northern California-San Francisco Bay areas. The new distributor is located in Berkeley, Calif.

Heading the new company is J. R. Williams, president, N. L. Lane, vice president, and W. M. Glade, treasurer.

Heading the parts and service departments are Harry Flossi and Jack Jones, respectively. Sales and service dealerships in nine cities in the northern California area will continue under the new distributorship.

Otis Engineering Corp. Names Malcolm B. Roach . .

as general sales manager of the Dallas oil-well tool-manufacturing and service firm. Roach, prior to joining Otis, was president of Dewey Supply Co. in Tulsa. He was also a regional sales manager for Dayton Rubber Co. in Dallas and Passaic, N. J.

Otis manufactures and markets a line of subsurface controls for oil and gas wells and also operates a fleet of wire line service units in the petroleum industry. The firm has branches in major producing areas in the Mid-Continent and Gulf Coast regions and subsidiaries in Canada and South America.

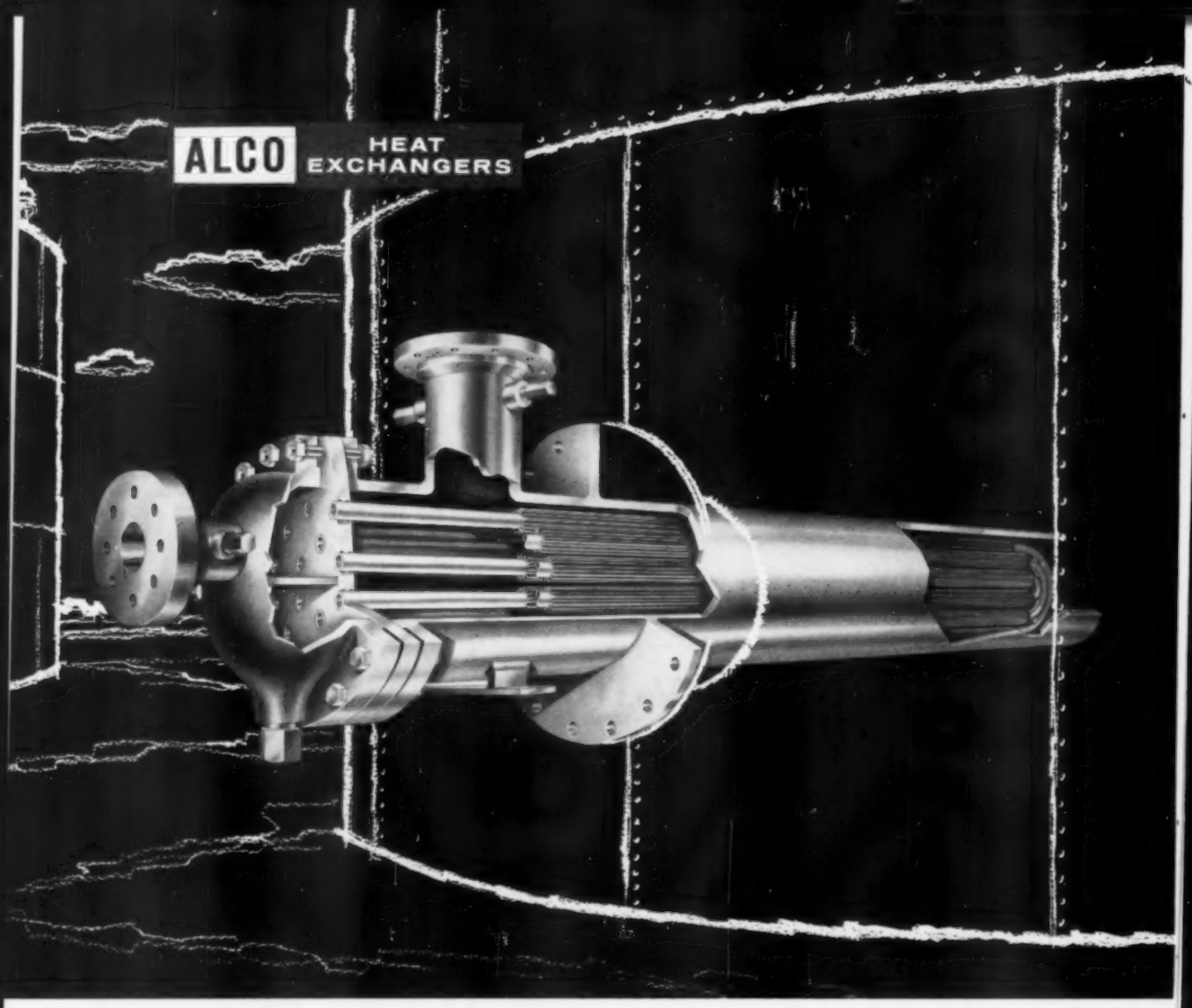
Burgess-Manning Co. Announces Appointments . .

of J. A. Kolb as sales engineer in the New York district office and of Louis G. Halla as sales engineer in the Chicago district office, both to serve in the industrial silencer division. The announcement was made by W. A. Carroll, general sales manager.

Kolb was in the Chicago area for 3 years. Halla's past associations include Walker Process Equipment, Inc., and Wallace & Tiernan, Inc.

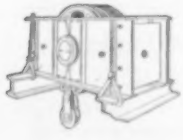
Dow Chemical Co. Opens Terminal at Midland . .

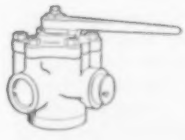
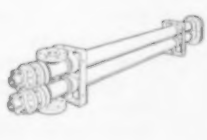
for gas-conditioning chemicals. The new terminal for rapid delivery to natural gas producers in West Texas,



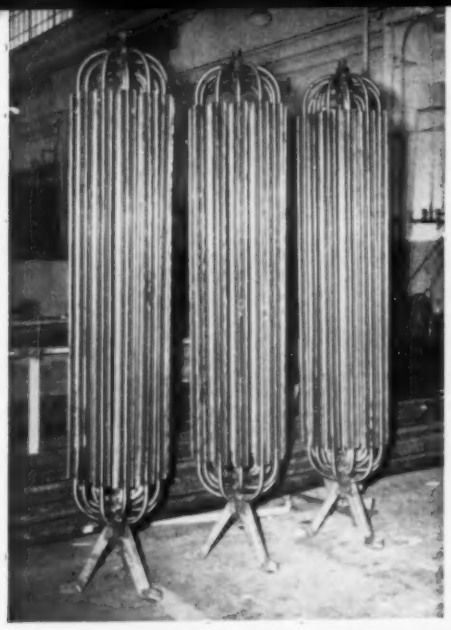
ALCO *tank suction heater with straight line heating does highly efficient job of heat transfer with minimum pressure drop.*

ONLY NEW ALCO FINNED TUBES MEET ALL PROCESS CONDITIONS

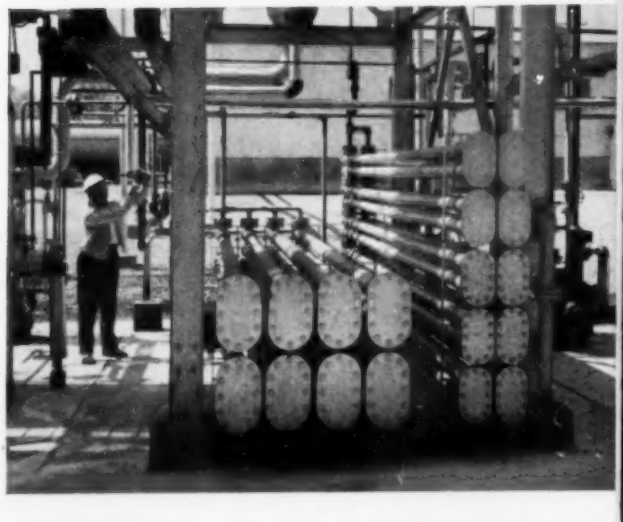


Crown and travelling blocks • Oil-field valves • Wellhead equipment • Kinney plug injectors • Finned tube products



ALCOHEATER, *mounted vertically in tanks, puts entire heating surface in contact with product. There is no restriction from accumulated sediment.*



ALCOTWIN® *heat exchanger offers "building block" versatility. Units can be simply rearranged to meet changing load or process conditions.*

Integral-finned tubes, made by ALCO, are the heart of every ALCO finned tube heat exchanger. Whatever your process application, you can select the precise fin and tube combination needed for best results. ALCO's welding method permits the widest range of metallurgy—carbon steel, stainless steel, low- and high-chrome alloys, non-ferrous alloys, Monel and Inconel.

Heat transfer characteristics of ALCO integral-finned tubes are unequalled. A gas-shielded tungsten arc welding process provides a fused metal-to-metal bond between the "U" shaped fin channels and the tube. This sturdy construction assures permanent contact between fins and tube through thousands of heating and cooling cycles.

For many heat-exchange applications, the flexibility and adaptability of ALCO finned tube heat exchangers make them your best buy—now and in years to come. Complete information is available from any of ALCO's sales offices, or write Petroleum Industry Equipment Division, Dept. 183, Bank of the Southwest Bldg., Houston.

ALCO

ALCO PRODUCTS, INC.
Petroleum Industry Equipment Division
HOUSTON

North Texas and southeastern New Mexico has been opened at Midland, Tex., and named Mid-Tex Terminal. It is operated by Dowell Incorporated.

Deliveries of chemicals to areas served by the terminal formerly were made from Freeport, Tex.

The new facility will stock bulk quantities of monoethanolamine, used in sweetening natural gas, and diethylene and triethylene glycols, used in dehydration.

J&L Supply Division Makes Store Manager Changes . .

at Lafayette, La., Houston, and Houma, La. A. G. Bastian, manager, field sales division, said that R. E. Holbrook, formerly local store manager at Lafayette, has been transferred to the Houston store in the same capacity.

B. M. Ferriss, formerly storeman advanced at Houma, is promoted to local store manager at Lafayette.

Holbrook joined J&L Supply as a storeman at Okmulgee, Okla., in 1945. He was promoted to local store manager at Lafayette in 1952. Ferriss joined J&L in 1951 as a storeman at Oil City, Miss. He was transferred to the Houma store in 1956.

Mercantile National Bank Names H. M. Smotherman . .

as a petroleum engineer in its oil department. Before joining the Dallas bank, Smotherman had been associated with Cities Service Oil Co. of Bartlesville, Okla., for several years. He is a member of the American Institute of Petroleum Engineers and is a registered professional engineer.

Jetwell, Inc., Opens Two New Field Stations . .

at Shawnee, Okla., and Winfield, Kans., to serve active development areas in Oklahoma and Kansas, according to W. L. Carwile, president.

Roy H. Cossey has been named district manager at Shawnee. The area to be serviced includes the central portion of the state.

C. E. Mullins has been named district manager at Winfield. A third station will soon be opened in western Kansas to extend services throughout that area as well as Northwest Oklahoma. Jack P. Pouland of Wichita will be manager of this region.

J. P. Stevens Is Acme Oil Tool Co. Vice President . .

at Oklahoma City. Stevens has been with Phillips Petroleum Co. for the past 28 years, serving as drilling superintendent since 1945.

J. P. STEVENS

Stevens began service to the oil industry by firing boilers for Harry Sinclair in the Tulsa area in 1908. He moved on to a job with Wolverine Oil Co., worked with Phillips, was next associated with C. W. Brooks, and from 1923 to 1930 did contract work for Phillips.

He was a division production superintendent for Phillips from 1930 until 1945 when he became drilling superintendent.

Stone & Webster Promotes Three Engineers . .

according to Fred W. Argue, vice president and engineering manager. Theodore E. Casselman, Jr., has been named assistant engineering manager, Normal L. Foskett, chief process engineer, is now chief engineer of the chemical division, and Stanley B. Zdonik is chief process engineer succeeding Foskett.

Casselman was employed by Worthington Pump & Machinery Corp., Jackson Engineering Corp., and American Locomotive Co. before joining Stone & Webster Engineering Corp. in 1940.

Prior to joining the company in 1941, Foskett worked for Tidewater Oil Co., E. I. du Pont, and Standard Oil of New Jersey.

Zdonik served with E. B. Badger & Sons Co. in 1942 which was merged into Stone & Webster in 1951. Since then he has been engaged in process engineering for a wide variety of chemical and petroleum plants.

W. O. Satterwhite, R. K. Hamilton Raised by Welex . .

according to information received from the oil well service company. Satterwhite has been made vice president and division manager of the newly formed West Texas division of Welex, Inc. Hamilton has been named division manager for the newly organized California division. J. E. Stough is assistant division manager.

The West Texas division of Welex includes districts in Abilene, Tex., with J. F. Magee as manager; Andrews, Crane, Brownfield, Monahans, and Odessa, Tex., all under the direction of D. M. Caviness as manager who has his office in Odessa; San Angelo with Gilbert Hester as manager; Snyder, Tex., with E. B. Schulz as manager; Artesia and Hobbs, N. M., under the direction of R. H. Williams manager in Hobbs. Wesley Krueger is a sales engineer in Roswell, N. M.

Stewart & Stevenson Names Sam McCleneghan . .

as a project engineer according to Joe Manning, vice president and general manager.

McCleneghan is one of the founders of Valley Manufacturing Co. in Valley, Neb., and was with that company 17½ years prior to joining Stewart & Stevenson Service, Inc.

With Valley, McCleneghan helped set up manufacturing and marketing systems for the self-propelled line of irrigation equipment.

Robert du Pasquier Tells Of Sahara Exploration . .

during his visit to Rogers Geophysical Co. in Houston. Du Pasquier is president of Exploration Geophysique Rogers, an affiliate of Rogers Geophysical. In a discussion with Sammy Rogers, head of Rogers Geophysical, he explained that the Sahara, a vast area in French West Africa, is a new oil frontier which promises to be a major factor in world production a few years hence.

Good reason for enthusiasm can be drawn from the few wells already completed. One of the wells, on a site pinpointed by geophysical work, turned up a new oil pay of 320 ft. Seven wells have been completed. Rogers currently has two crews operating in the Sahara.

Sammy Rogers, left, and Robert du Pasquier, check latest in magnetic tape playback equipment.

Mid-Continent Supply to Sell Delta Tank Products . .

as world-wide (except Mexico) exclusive distributor. This joint announcement was made by President Ken W. Davis of Mid-Continent Supply Co. and President Hal S. Phillips of Delta Tank Manufacturing Co. The sales agreement covers sales and service of oil field equipment to the export, domestic and Canadian markets.

In a recent sales meeting attended by all division managers and executives, Ross Baze, Delta Tank vice president and sales manager of oil field equipment, outlined an intense training program for sales and service for Mid-Continent Supply Co.'s sales organizations.

Attending the recent sales meeting held for Mid-Continent Supply Co. personnel by Delta Tank were: J. A. Daugherty, vice president of Mid-Continent; Ken W. Davis, Mid-Continent president; Ross Baze, Delta; and D. H. Thornbury, Mid-Continent executive vice president.

BJ Service Name Adopted By Chemical Process Div.

The announcement was made by John B. Merritt, BJ Service, Inc., executive vice president and general manager.

General offices for the combined operation will continue to be in Long Beach, Calif. R. G. Miller, vice president and assistant general manager, will be headquartered in the company's Fort Worth offices.

JOHN B. MERRITT

R. G. MILLER

Chemical Process has been operating as a separate division of BJ Service since their merger. It had specialized in oil-well acidizing, fracturing and special chemical treatments throughout Texas, Oklahoma, Louisiana, Kansas and New Mexico.

BJ Service provides cementing services in Texas, New Mexico and Louisiana and cementing, fracturing, acidizing, perforating and radioactivity logging in California and Rocky Mountain fields. Under the unified program, BJ Service now comprises 60 field stations, 800 units of mobile equipment and a staff of 900.

A new plan of organization and operation has also been adopted. It divides BJ Service into five operating divisions: Divisions, division headquarters, and managers are: West Texas, Midland, L. H. Kaltenberger; Mid-Continent, Fort Worth, B. L. Crone; Gulf Coast, Houston, C. R. Cross; Pacific Coast, Long Beach, J. T. Streger; Rocky Mountain, Denver, C. Z. Hughes.

Execuives sales officers named are G. R. Whitney and F. D. Smith. Operations will be managed by W. T. Box, with J. V. Derrick as assistant manager. The engineering development and manufacturing division will be consolidated under the managership of M. B. Riordan in Long Beach.

Four Wheel Drive Auto Co. Starts Dealer Meetings . .

with a Southwest dealer session at the Duncan, Okla., sales and service branch. Sales conferences are under the direction of G. F. DeCoursin, FWD vice president-sales, and Lloyd L. Pernot, domestic sales manager.

FWD market specialists C. H. Welch, fire apparatus; Warren Snider, commercial, and John Casey, utilities, as well as Howard R. Canada, director of parts and service, and Arthur J. Laack, advertising and sales promotion manager, are participating. The sales conference program is planned to acquaint FWD's old and new dealers with the latest FWD product features and sales policies.

FWD dealers from ready-mix, fire-fighting, transport, oil-field, construction, logging, road maintenance, utilities, and related markets are included in sales conferences held or scheduled for Buffalo, N. Y., Portland, Ore., Minneapolis, Minn., and Indianapolis, Ind.

Graver Tank Announces New Sales Personnel . .

in its oil and gas equipment division, to serve at Dallas and Fort Worth. R. L. (Bob) Gibbins has been appointed Dallas representative, and J. G. Byer is now Fort Worth representative.

Gibbins has been engaged in oil and gas equipment sales and service for most of his working life throughout the Mid-Continent and Rocky Mountain regions. Most recently, he has been Dallas representative for Lone Star Steel Co.

Byer has had charge of Graver Tool & Manufacturing Co., Inc.'s Kansas operations since 1953, and has previously had several years experience in oil and gas equipment sales in Midland, Tex. He succeeds Henry McCabe, recently transferred by Graver from Fort Worth to Tulsa.

Delta-Desco of Texas, Inc., Is New Texas Coporation

The announcement was made by C. F. Clure, president of Delta-Desco companies. Home offices of the company, formerly Delta Engineering Sales Co., are in Houston.

R. D. LINDSEY

Delta Engineering Sales and Desco Service Co. provide valve-lubrication service. The new organization will operate the Houston, Corpus Christi, Odessa, Amarillo, and East Texas offices.

Sales will remain under the supervision of R. D. Lindsey, general sales manager of Delta-Desco.

David C. Guinn Joins Shaffer Tool Works, Inc. . .

D. C. GUINN

as division engineer in the Mid-Continent Gulf Coast area, according to Carl W. Vogt, Mid-Continent and Gulf Coast manager.

After graduating from the University of Texas in petroleum engineering, Guinn joined The California Co. at New Orleans, La., and was with them from 1951 to 1955 as a drilling and area production engineer on offshore and inshore drilling and development operations. Guinn will be stationed in the Houston office.

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Geophysical exploration techniques which are effective in the Middle East may also work to your advantage in West Texas, or in your other problem areas.

GSI brings to your exploration program 28 years of varied experience in 38 countries, and it is this experience that permits GSI to evaluate your problem area in the light of geophysically similar areas . . . although they may be thousands of miles apart.

Whether camels or cows dot the landscape, the experience GSI gains in each prospect area is applied in other areas, through a process of "melting down" by the GSI Geophysical Engineering Department and dissemination through training programs and direct field application.

GSI . . . continuing leadership through research and growth

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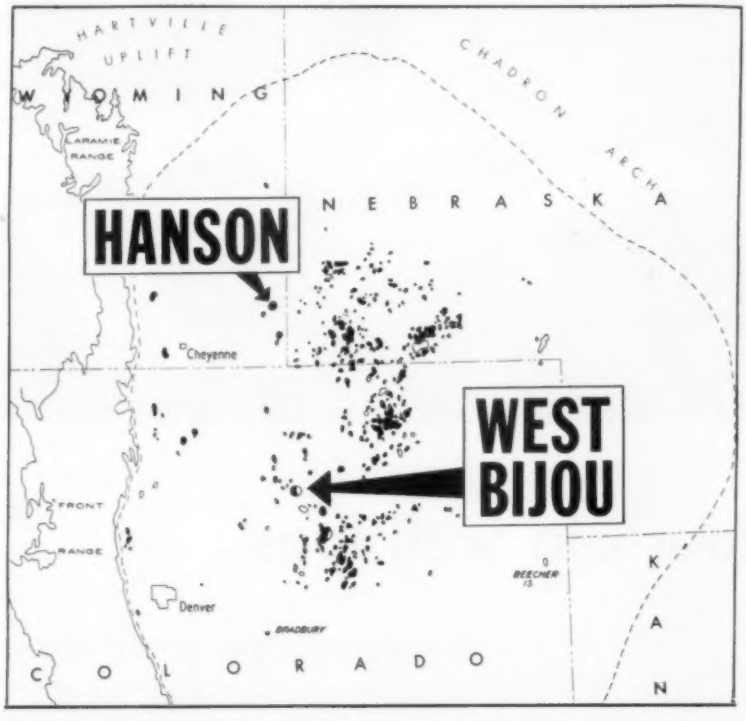


WEST BIJOU FIELD is one of the best discoveries in many months for the tristate Denver basin. Potentials in the 1,000-bbl. class accent the importance of the strike. Wyoming shares the spotlight with new discoveries in Golden Prairie field, Laramie County.

Good strikes prod sleepy Denver basin

BY FRANK J. GARDNER

IS THE DENVER BASIN on the skids? Doubtful. You can hear lots of snide remarks about the basin from those who lost their shirts there. But if you sit down and analyze its pros and cons, it's difficult to conclude that this basin has had it. What's more, you'll find that Denver basin wells compare quite favorably with those of similar provinces.

Reserves are good . . . In a recently published article, one Colorado geologist, Rex Monahan, of Sterling, came up with some revealing statistics on performance records in the Denver basin. He studied the cumulative production per well and concluded that, contrary to the general belief, the reserves per well are not particularly low. Here are his figures (data as of March 1957):

Producing wells	Avg. cum. prod. (bbl./well)
520	Plus 100,000
141	75-100,000
594	50- 75,000
657	25- 50,000
374	0- 25,000

Monahan's point is that these figures compare well with production performance in the Illinois basin, Central Kansas, and eastern Powder River basin provinces. And he's right.

And attractions numerous . . . The Denver basin is still a fertile hunting ground for the aggressive independent. There are plenty of places to drill, pipelines are plentiful, the oil is high gravity, depths are shallow, and drilling is cheap. Top this off with a sweeping wave of lease expirations about to engulf the area, and there's only one conclusion to be reached: the Denver basin is **not** on the skids. More likely, we'll see drilling perk up a lot between now and 1960.

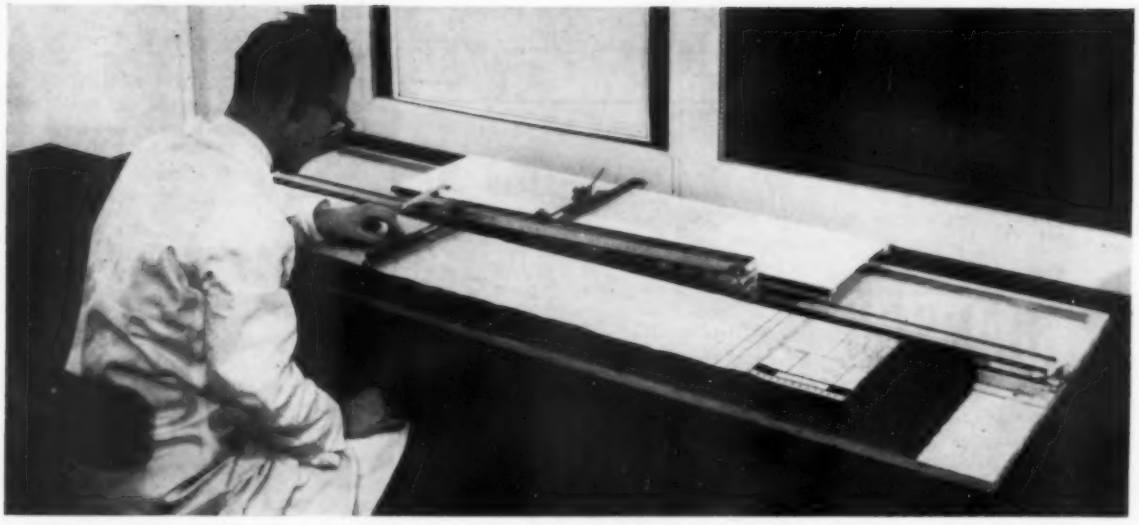
That the rewards are still there to be found has been amply demonstrated the past month. In Morgan County, Colorado, the best discovery since Nebraska's Sloss field is in the first stages of growth. This is West Bijou field. It was opened on January 18 when Williamson & Kissinger 1 Matthews (Section 12-4n-60w) flowed 930 bbl. per day on a ½-in. choke from Dakota-Cretaceous D sand at 6,182-96 ft. Only 10 days earlier, these operators had finished a fine gas well 2 miles east of the oil discovery well; this was the 1 Bijou Irrigation District "A" in Section 8-4n-59w, with initial flow of 13,500 M.c.f. gas daily from Dakota D sand at 6,072-88 ft.

Williams & Kissinger's first offset was to the north. It was 1 Conine (Section 1-4n-60w), completed for 42 bbl. per hour on ¾-in. choke; this thousand-barrel strike also was a D sand producer. Next came a 250-bbl. south offset at British American Oil Producing Co. 1 Bender in Section 12-4n-60w. Today, seven more rigs are spinning away at West Bijou, and more are on the way.

To further add to the attractiveness of this new field, Bill Tomberlin's 1 Ehlrick, a west offset to the West Bijou discovery in Section 12-4n-60w, has found commercial oil in the deeper Dakota J sand at 6,255-75 ft.

In more states than one . . . Meanwhile, in the Wyoming portion of the Denver basin, another new field shapes up. Laramie County's Hanson area, now a part of Golden Prairie field, had an important confirmation finished at Wyoming Western Oil Co.'s 1 Scheel, in Section 21-16n-61w. This one lies north of the operators' 1 Hanson, a 1957 discovery, and south of the same operator's 1 Floy, the original 1957 Golden Prairie strike. It pumped 140 bbl. daily from the discovery J sand at 7,704-20 ft. The two earlier wells in the field made 170 bbl. each from J sand.

The Denver basin isn't dead. It may have "tired blood," but a few more strikes like West Bijou, plus the thousands of acres of expiring leases. will lead to a major transfusion during the next 2 years.



With equipment like this, you can . . . (Fig. 1).

Freshen up your old well logs

A new process might show secrets overlooked in the initial field inspection

BY R. M. RAMSELEN
Iraq Petroleum Co., Ltd., London, England

MUCH TIME AND THOUGHT has been given in recent years to the petroleum-engineering interpretation of well logs, but their use in other equally important subsurface problems has tended to be neglected. As a result of this uneven progress the industry has not received full benefit from many surveys.

This is especially true of those from the 90 per cent of exploratory holes which find no commercial oil accumulations. Many such logs require a negligible amount of petroleum-engineering evaluation. However, they ought to be thoroughly studied for possible amplification of geological or geophysical explanations of poor producers or dry holes. Properly handled, they will almost always provide some constructive information.

Unfortunately geologists and engineers have received little guidance in manipulating these logs apart from the application of formulas and graphs for estimating petrophysical properties. Many geologists are not even aware that the logs can be transformed and transcribed in the office almost as effectively as magnetic seismic recordings can be replayed and analyzed. The recording of seismic information on magnetic tape transfers from the field to the office the time-consuming procedure of selecting the correct filtering system. It is equally advantageous and practicable to transfer the derrick floor to the office the selection of the best logging scales for each well survey.

Not only is this sound economics but in practice so much of the general interpretation of electric and similar logs rests on visual appearances and comparisons that some form of office treatment has become almost essential as logs steadily increase in numbers, complexity, and styles of presentation. To cite a typical but elementary example, it is almost impossible today to identify by the original recordings only a repetition fault spanning several early hand-recorded surveys by checking the section against a modern multitrace automatic recording from a nearby location.

This obvious need for freely changing log scales has always been recognized by experienced interpreters. Such revisions, however, have been made infrequently in practice because of the laborious effort and rather crude results of replotting by hand or even by the use of special rotary photocopiers with cylindrical lenses.

A new instrument . . . Recently, however, this difficult task of changing two scales independently of each other has been greatly simplified by the development of an easily operated desk or bench-top instrument. It rapidly copies any original log onto blank paper or onto prepared forms with almost any degree of scale adjustment to the depth or width (peak height) dimensions (see Fig. 1). These two scale adjustments need not be in the same proportions nor in the same sense.

Thus, the amplitude or width scale may be enlarged, for example, six times while the depth scale is simultaneously being reduced to one-tenth of its original size. With this new instrument, which is manufactured by Messers Fenn Ltd., Charles Place, London, N.W. 1, England, the interpreter has at his disposal in the office at least as wide a range of scale adjustments as those available to the logging operator by the scale-setting controls on his recording equipment.

Furthermore, the copies produced are all clear and uniform in appearance irrespective of the type of log or equipment used to record the original. No developing or printing is required throughout, although occasionally the original should first be enlarged photographically to ensure best results.

For more intricate studies, any variety of continuously recorded data, including gas detector and penetration rate, can be reproduced on the same sheet in distinctive colors.

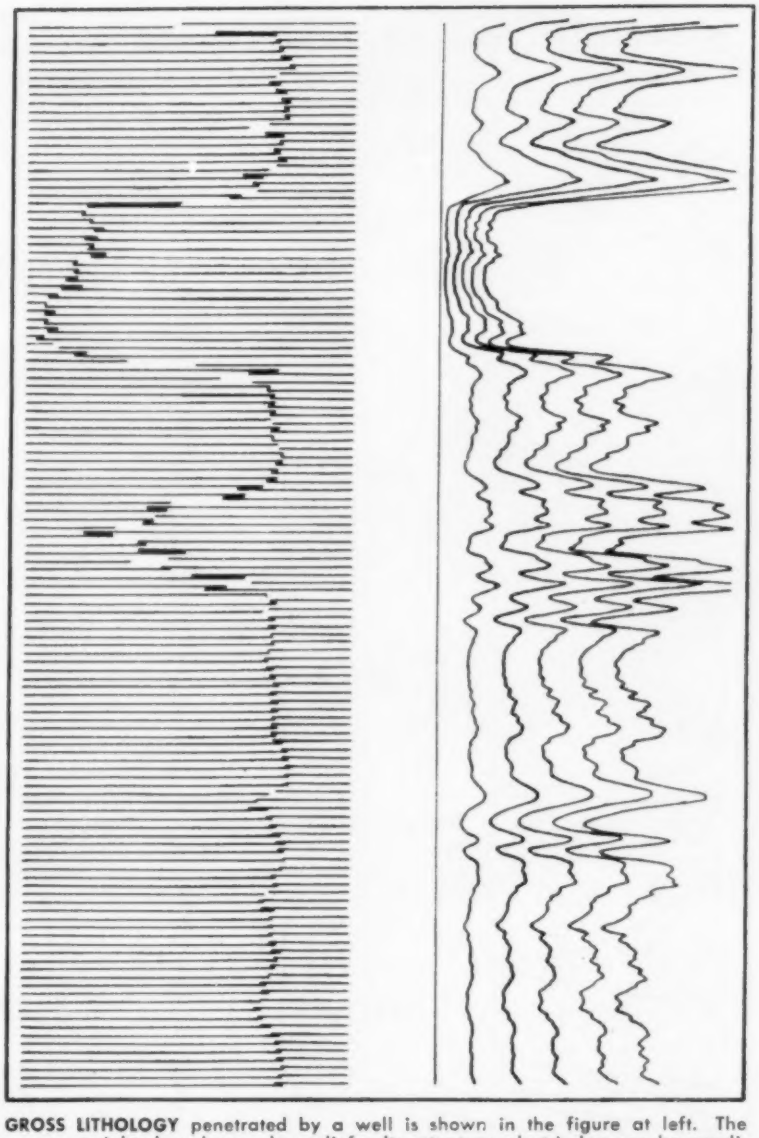
First-class results . . . Reproductions made by this instrument have provided the means of interpreting critical subsurface features which may have lain unrecognized for years on originals difficult or impossible to interpret because of unsuitable recording scales or incompatible overlaps at cardinal depths. Some of the actual capabilities of the new instrument are shown in the accompanying illustrations:

Fig. 2 is diagrammatic. The hatched-line reproduction on the left is useful for softening detail to block-out broad stratigraphic divisions or for the comparison of logs of somewhat different type but with certain responses in common. The latter operation is valuable where, for example, a hole logged by today's gamma ray and microdevices is to be compared with a much earlier hole logged only by standard S.P. and resistivity methods.

On the right of this illustration are five successive enlargements of the amplitude scale of a rather flat resistivity log, the X 5 enlargement on the extreme right corresponding exactly to an "amplified normal" as recorded on many modern logs. This form of enlargement is especially useful where surveys have been made in very saline drilling fluid as experience has shown that a considerable amount of authentic detail can be present in such logs although the relief of the original recording appears inadequate.

In Fig. 3 we see the advantage of contracting long detail-scale logs to a length at which the entire section can be viewed at once. The overturned field shown on the left of the illustration was neither discovered nor suspected until the original gamma ray log had been shortened from 16 ft. to approximately 3 ft. in total length. As a result, the twice-repeated "mirror image" appearance of an overturned fold became readily visible.

The Laterolog and section gage, which were each originally on different depth scales, were then correspondingly processed and reproduced directly alongside the gamma ray log for additional information regarding the position of the anhydrite and salt beds capping the potential limestone reservoir rock. Dips were added from dipmeter and core data.

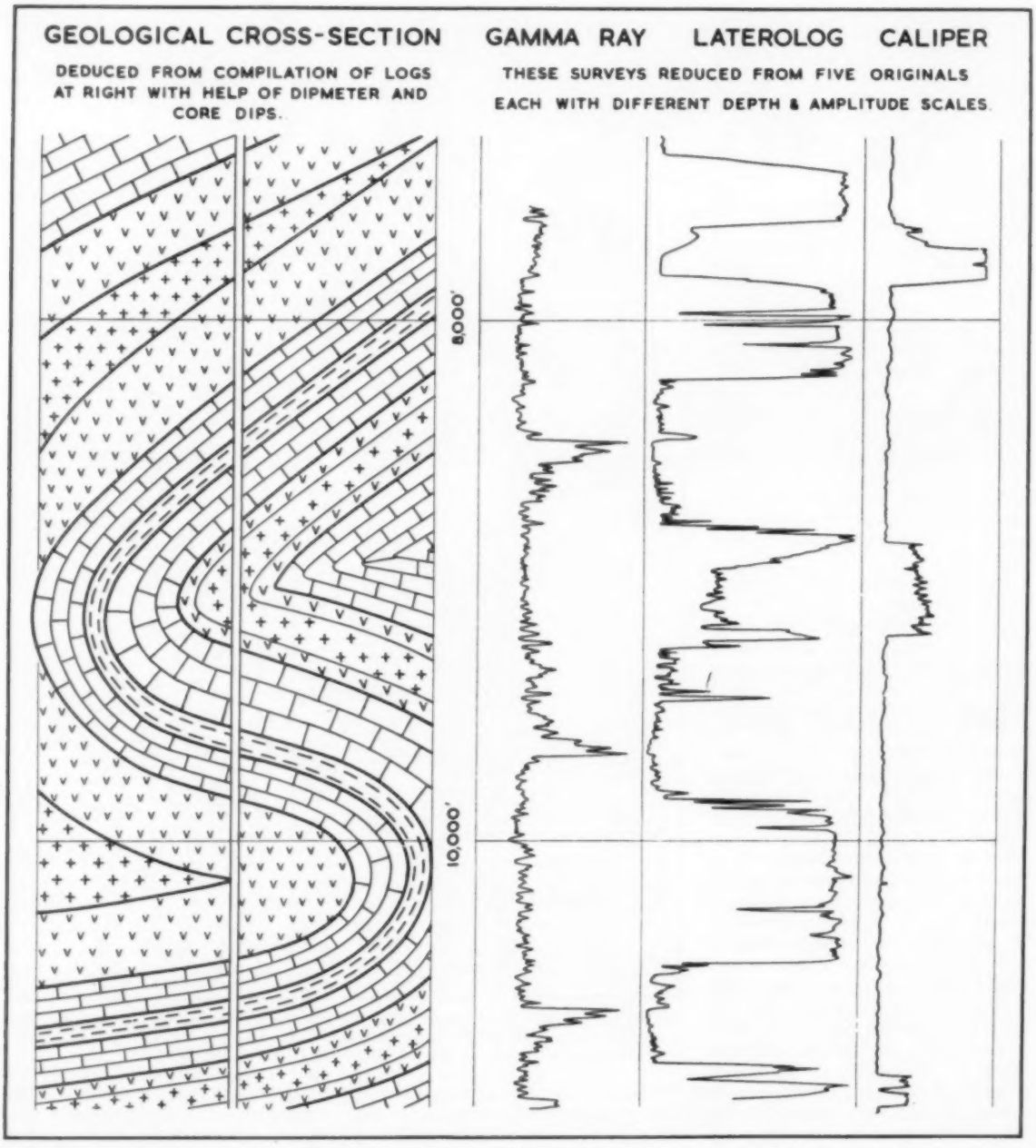


GROSS LITHOLOGY penetrated by a well is shown in the figure at left. The curves at right show how a low-relief salt-water-type electric log can be amplified (extreme left curve) to provide better definition. Fig. 2.

This entire process, almost impossible to achieve satisfactorily by conventional drawing or photographic apparatus, required less than an hour with the new instrument. The operating company then recognized the unusual structural position and the true thickness of the reservoir rock of this inconclusive 12,000-ft.-deep test. Future locations can now be planned accordingly.

Fig. 4 represents an important discovery resulting from the uniform reproduction, at scales selected by the interpreter, of a heterogeneous collection of three early hand-recorded and two modern, automatically recorded surveys in adjacent holes. After standardization of the amplitude scales, depth scales, and track widths it was clearly evident that approximately 2,300 ft. of water-bearing section in No. 1 showed a significantly higher average resistivity in No. 2 and at about the same structural elevation. Owing to the wide difference in the visual appearance of the originals, this marked resistivity discrepancy had previously escaped notice.

Reference to drilling reports disclosed that as a result of a small initial blowout large quantities of heavy


GEOLOGICAL CROSS-SECTION
DEDUCED FROM COMPILATION OF LOGS AT RIGHT WITH HELP OF DIPMETER AND CORE DIPS.
GAMMA RAY
LATEROLOG
CALIPER
THESE SURVEYS REDUCED FROM FIVE ORIGINALS EACH WITH DIFFERENT DEPTH & AMPLITUDE SCALES.
8,000'
10,000'

COMPOSITE CURVE made up from five separate logs immediately reveals the overturned fold shown in the cross-section at left. Interpretation is supported by dipmeter and core data. Fig. 3.

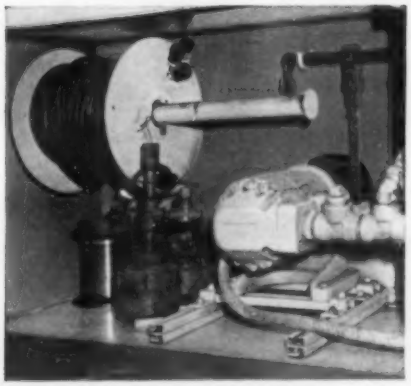
mud had been used throughout this section in No. 2. This treatment had completely masked the great thickness of potentially oil-bearing section of which there had been no indication in No. 1. The operating company, forearmed with this indication of what is believed to be an unusually thick stratigraphic accumulation at these levels is now contemplating a further test on this prospect.

Essential requirements . . . The basic requirements for successful log manipulation and interpetation are these:

- The interpreter is greatly assisted by the transfer of scale selection, apart from that of the original recording from the derrick floor to the office.
- As the eye can encompass only about 18 in. of log at normal viewing distance the full span of significant events must be brought within this range if possible. This may require the conversion of normal depth scales to miniature scales of 1 in. to 500 ft. or more but the width or amplitude scales will almost certainly not require reduction in the same proportion (otherwise the pattern becomes too small to view comfortably).
- The presentation must comprise as few lines and be of as uniform appearance as possible.
- Extra-large detail scales are not helpful in this class of work and ultimate quantitative precision can be profitably sacrificed to a fair extent to obtain a more easily studied log.

Modifying scales . . . Successful re-

Finger-tip control for **OTIS** wire line mobile unit with **DENISON** 2000 psi hydraulic system



DENISON 2000 PSI TME VANE-TYPE PUMP . . . shown mounted inside van, is driven by engine power take-off.

THIS new wire line mobile unit—developed by Otis Engineering Corporation, Dallas, Texas—puts *Denison hydraulic power* to work lowering, retrieving and manipulating sub-surface oil well controls at depths of 15,000 feet-plus.

One operator has complete control over all the wire line. Lost motion and communication error between operator and helper are eliminated. Wire speed in both directions is higher both in the hole for jarring down—and out of the hole for upward jarring.

The reason: a dependable Denison 2000 psi hydraulic system . . . incorporating Denison TME balanced-vane pump and motor . . . that affords sensitive finger-tip wire line control. Combined with the hydraulic system are electronic controls that essentially eliminate all human element from this efficient well-servicing operation.

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BANK OF THE SOUTHWEST, HOUSTON

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

"As the eye can encompass only 18 in. of log at normal viewing distance, the full span of significant events must be brought within this range if possible."

sults are not always achieved immediately, however. Considerable judgment must first be developed as to the extent to which scales require modification for each purpose. Some of the more important factors concerning depth and amplitude-scale alterations are explained below:

The depth scale may merit adjustment in conjunction with or independently of the amplitude scale in several circumstances, for example:

(1) Where a log is to be directly compared with another recorded on a different depth scale.

(2) When the over-all length of the original is too great for important large-scale features to be readily seen within a few inches of pattern at normal viewing range.

(3) If consecutive logs in the same hole are to be joined, as where important events straddle two or more surveys, and the originals have been recorded at different depth scales.

(4) When a survey made in a steeply dipping and hence apparently thickened section is to be compared with its counterpart in the same section logged elsewhere at low dip or horizontal. This condition may exist in one hole and on one survey if a repetition fault or overturn has been penetrated.

(5) On logs from inclined holes in which the section appears unduly thick and comparisons are needed with logs from nearby vertical holes exhibiting true section thicknesses.

(6) Where local or regional correlations are sought in sections varying widely in stratigraphic thickness from place to place. The reduction of all logs to a uniform length can greatly assist in the recognition of sedimentary rhythms or persistent features of potential use as marker horizons or as control levels for isopachyte and lithofacies ratio maps.

In the last three instances, it will often be necessary to introduce depth scales of unusual proportions. For example, to rectify a log recorded at 1 in. per 100 ft. through a section dipping at 65°, the depth scale must be reduced to 1 in. per 236.6 ft.

A similar conversion is necessary if the hole is inclined at 65° in horizontal beds, or if a section, say, 2,070 ft. in thickness is to be correlated with an equivalent stratigraphic interval only 875 ft. in thickness at another location. These fractional scales are beyond the scope of conventional logging equipment even if their need could be foreseen prior to the survey. They are now quite easily obtained, however, by subsequent office processing of the standard-scale originals.

The amplitude scale determines the relief of a recording, i.e. the relative heights of the peaks and valleys and this relief can often be modified with advantage. For instance:

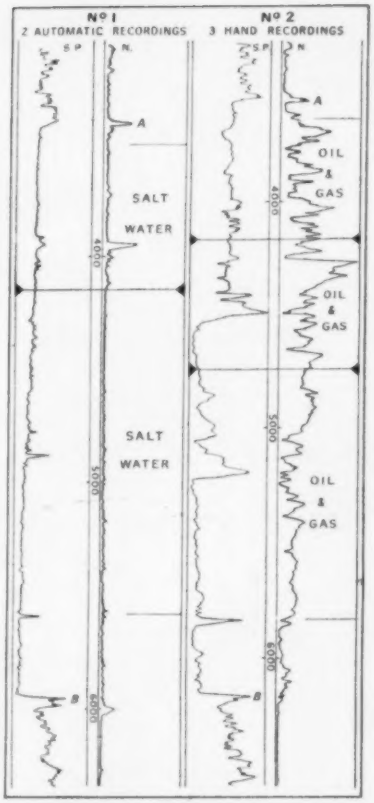
- As a complementary process to a change in depth scale so that logs reduced in length retain their original relief.
- When a survey is bewildering in appearance as a result of a very sensitive recording scale having been used, which repeatedly sweeps the first and even the second registrations beyond the track margins.

Although the accuracy with which readings can be taken is enhanced by this technique, the appearance of the log is too disconnected for convenient visual appraisal. Some of the modern microdevices are frequently recorded in this manner; it is always advisable to rescale these so that the entire recording falls within one track before attempting a general geological interpretation.

- To provide clear, neat illustrations for reports, published articles and lectures, where appearance is of more consequence than the accommodation of the track width to a standard round-figure value such as 100 millivolts, or 500 ohms. In Fig. 4 of this article for example, the full span of the short normal resistivity tracks of the five surveys variously represents magnitudes of 70, 83, 116, 157, and 267 ohms, although the original recordings were made at either 50, 200, or 250 ohms per track.
- If a series of logs of markedly different relief are to be joined together. This operation is especially necessary when faults or other significant features straddle several consecutive surveys.

Ideally, electrical and radioactivity logs can be so joined only if the original surveys were made under identical conditions. In practice, however, satisfactory unions are achieved by averaging corresponding peak heights at overlays and adjusting the proportions of one or both logs accordingly.

If no overlap is available, the adjustments can sometimes be estimated visually, or more positively by reference to an unbroken survey of the same section elsewhere. If neither the visual nor the comparison methods are possible, then the necessary degree of proportioning can sometimes be inferred from the bore-hole data by the use of resistivity departure curves and other data.



PROPER COMPOSITING of three early hand-recorded electric logs shows a 2,300-ft. section that is potentially oil or gas bearing. Fig. 4.

Gas detector, section gage, penetration rate, and similar mechanical logs plotted on a linear-magnitude scale can always be joined directly by simple proportioning.

Obviously, the need for office treatment of logs reflect no discredit on the operators who produce the original recordings. It is entirely due to the commendably high average standard of the operators' workmanship that such manipulations can be confidently undertaken. The operators, nevertheless, under constant pressure of costly rig time and often with limited knowledge of the section being surveyed, are not always able to produce ideal logs suitable for every form of subsurface study. An attempt has therefore been made here to demonstrate the wide range of subsequent modification validly available to every interpreter at his own desk and of the facility with which this work can be done with a suitable instrument.

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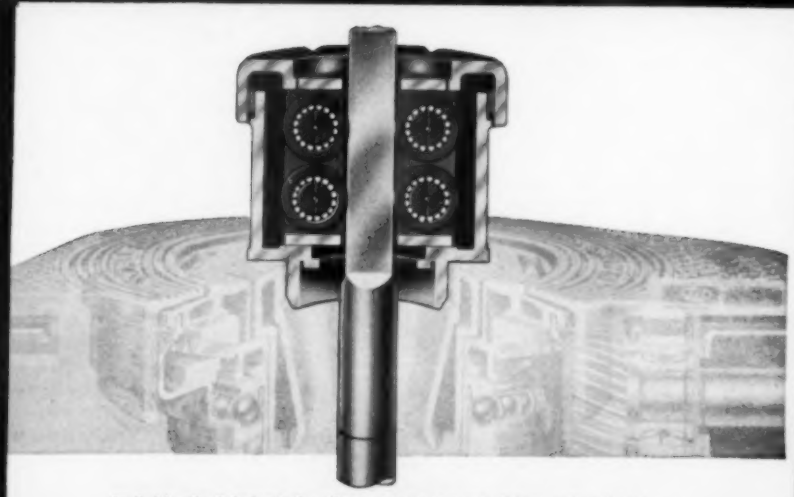

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Deep oil found in San Juan basin

RANK DAKOTA oil production was opened inside Blanco gas field in the San Juan basin of northwestern New Mexico.

The discovery well is Skelly Oil Co. 3 Roberts, NE SW SE 18-25n-3w, Rio Arriba County. It flowed 171 bbl. of oil per day from Dakota sand (Cretaceous) at 7,996-8,077 ft. on 20/64-in. choke.

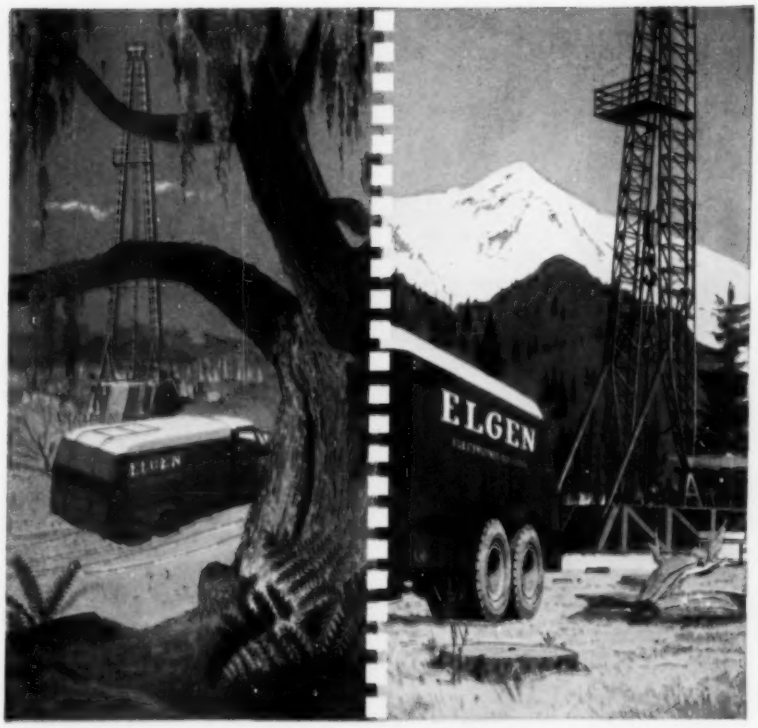
Gas strike . . . On the east side of the San Juan basin, Humble Oil & Refining Co. opened new gas production at 1 North Lindrith Unit in NE SW SW 20-26n-2w, Rio Arriba County.

Humble's strike flowed 1,024 M.c.f. of gas per day from Pictured Cliffs sand perforations at 3,778-3,842 ft., and the well flowed 2,697 M.c.f. per day from the Mesaverde at 5,486-5,675 ft. Nearest production is 1 mile west.

Blanco wildcat hits new Cretaceous pay

THE GALLUP SAND is a new pay in the Fulcher-Kutz area, inside Blanco gas field, in the San Juan basin of northwestern New Mexico. W. R. Weaver and A. N. Brown tested 10,000 M.c.f. of gas per day from perforations at 6,272 ft. at the 1 McAdams wildcat in NW SE NW 34-27n-10w, San Juan County.

The operators are going to test an indicated oil section at 6,117 ft., also in the Gallup. Production in this area, which lies north of the Bisti and Gallegos Gallup trends, is from Pictured Cliffs sand. The closest Gallup production is 8 miles southwest.



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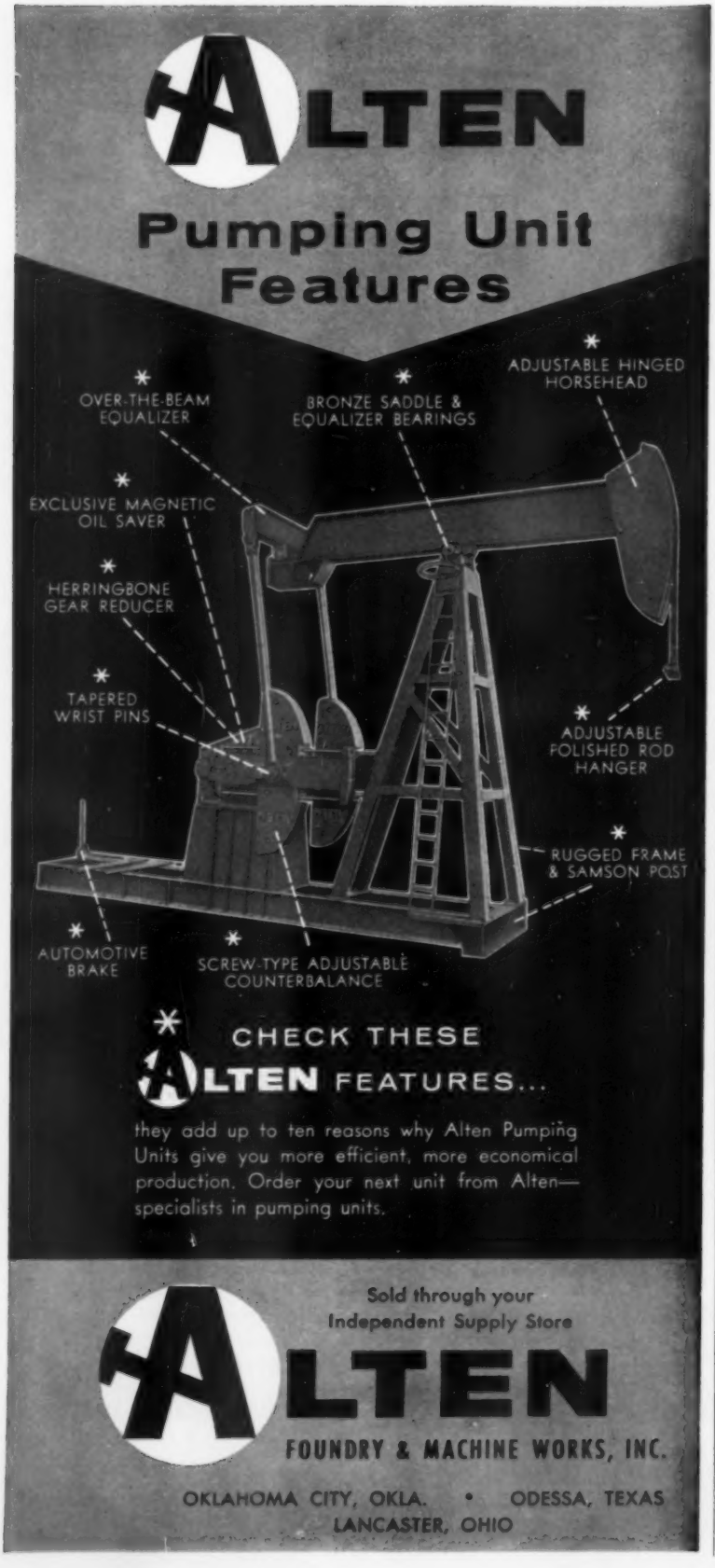
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California movie lot has Miocene find

UNIVERSAL CONSOLIDATED Oil Co. reports it has tapped a new Miocene zone pool with 3F Twentieth Century Fox on the firm company's movie lot in West Los Angeles.

Because of the highly competitive condition existing around this area, the operator didn't reveal the perforated interval. However, total depth of the well is 3,729 ft. with 11¾-in. casing set at 3,356 ft. and 7-in. casing set to an unknown depth below that. Initial production was reported as 576 bbl. daily of 25.5°-gravity crude through a 28/64-in. choke.

Universal has two rigs busy slant-drilling its movie lot and neighboring leases from sites on the movie lot itself.

California highlights . . . Flamingo Oil Co. has temporarily suspended operations at 2,000 ft. on its 1 Flamingo in the Dead Mountain area of the Mojave Desert near Needles. The drilling rig was being moved out. . . . In the Salton Sea area of Imperial County in the extreme southern part of the Mojave Desert, Kent Imperial Corp. had resumed operations on the formerly idle 4,740-ft. 1 Sinclair. The operator reports repairing a hole in 3-in. pipe at 3,200 ft. through which brackish water had flowed, and was getting ready to drill out cement.

Ventura County Still Hitting Pliocene Success

Two recent excellent producers brought in by The Texas Co. in Bridge pool-South Mountain field of Ventura County point up the continuing value of drilling for Pliocene production under the Oakridge fault.

The most significant of the two Texaco wells is 2 Texas-Union-Norcup. It was dually completed in two zones. The upper zone, "Saticoy 5," was brought in for 508 bbl. daily of 34.7°-gravity crude through a 24/64-in. choke from perforations at 8,465-8,580 ft. The lower zone at 8,627-99 ft. made 402 bbl. in 18 hours. The lower zone crude tested at 34.4° gravity. Flow was through a 20/64-in. choke. This well is located on the southwest edge of the Bridge pool activity.

The other Texaco well is 2 Texas-Union-Stine B located on the north flank of the pool. It was completed in a subfault Pliocene sand at 7,332-7,830 ft. It flowed 465 bbl. daily of 31.8°-gravity crude through a 20/64-in. choke.

SOUTHWESTERN NEBRASKA'S Hitchcock County has a Lansing-Kansas City Pennsylvanian oil discovery, 23 miles northeast of recently opened Jones field in Dundy County.

Nebraska's Cambridge arch scores again

HITCHCOCK COUNTY in southwestern Nebraska has a new Lansing-Kansas City strike. It is Brack Drilling Co. 1 Hudson, C NE NE 1-1n-34w, 23 miles northeast of nearest similar production in new Jones field, Dundy County.

The operator recovered oil at the rate of 6 bbl. per hour on pump test of perforations at 4,082-88 ft. This is the second discovery in this portion of Nebraska in recent weeks. Jones field was opened in January, reviving exploratory interest in this sector. The two new producing areas are in the triangle formed by the Las Animas arch and the Cambridge arch.

Utah's Paradox gets its first '58 hit

SOUTHEAST UTAH'S Bluff Unit got its third producer last week—and the best well in the unit to date. Shell Oil Co. completed 24-5 Bluff Unit in NE SE SW 5-40s-23e, San Juan County, for 1,690 bbl. of oil per day. Production is from Pennsylvanian.

The new Paradox basin discovery, first of the year in southeastern Utah's portion of the basin, is 1 mile southwest of the field discovery, Shell 3 Unit. That well was completed 2 years ago for 138 bbl. of oil and 31 bbl. of water per day. The field confirmation well, Shell 33-4 Bluff Unit, made 120 bbl. of oil per day on 1-in. choke.

Wells to the northwest and west of these successes found no production. The prolific success at Shell's new strike erases some of the doubt as to the area north and west of Aneth.

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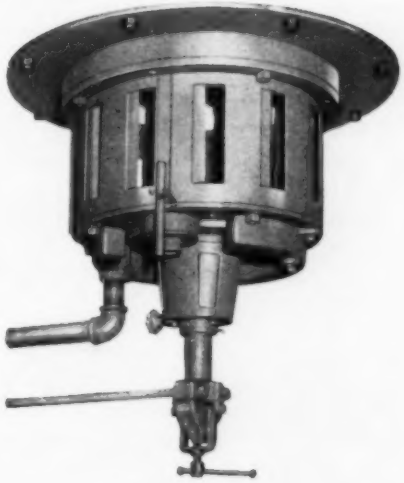

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In a flurry of February discoveries . . .

Devonian is new mountain target

BY JOHN C. McCASLIN
District Editor

THE CANADIAN ROCKIES and northern Alberta took a firm hold on February exploratory success.

Discovery of Devonian gas at Panther River in the Rocky Mountains of Alberta and more Beaverhill Lake-Devonian oil in the famous Virginia Hills region in the northern part of the province gave western Canada the success nod over other developments on the North American oil scene.

Devonian gas . . . Shell Oil Co. came up with the two most significant discoveries in western Canada, one in the mountains, the other in the plains.

Devonian reef gas was tapped at Shell's Panther River wildcat in southwestern Alberta's mountainous area, north of the city of Banff, and just outside the Banff National Park limits. The wildcat flowed at the rate of 7,200 M.c.f. per day during tests.

Successful completion of the Panther River wildcat will give the growing foothills gas trend in Alberta its second Devonian-producing area. Last year at Lambert Creek Devonian gas was uncovered at Canada's deepest hole. Most production along this prolific gas trend building up in southwestern and western Alberta's mountains is from thick Mississippian zones. The trend begins near the United States border at Waterton Park; it extends northwestward towards British Columbia—dotted with Mississippian gas fields along the way (Gladstone Creek, Castle River, Savanna Creek, Stolberg, Brazeau, Lovett River, and Mountain Park-Triassic).

The discovery of additional Devonian gas along the foothills and Rockies trend points up the tremendous potential of these rocks as new exploratory targets in this region.

Devonian oil . . . Last year's noted Beaverhill Lake-Devonian oil finds in the Virginia Hills, Swan Hills, Edith Lake, Kaybob, and Iosegun River areas of Alberta will hold the industry's attention in western Canada for some time. Shell gave further notice of this huge area's potential in February with discovery of oil at its 10-17-64-13 Swan Hills, 7 miles south of Virginia Hills. Testing continues at the newest Beaverhill Lake find.

At the west end of the middle Devonian reservoir Phillips Petroleum Co. completed the third well in the Kaybob area. The well flowed at the daily rate of 3,274 bbl. on ¾-in. choke.

In the United States . . . Exploration south of the Canadian border in February resulted in widespread success from California to eastern Kentucky.

Pacific Coast . . . Superior Oil Co. paced California drilling news with an excellent offset to its recent new pool

on the south flank of Paloma field in Kern County. The company brought in 74-10 KCL as a dual completion in the Miocene Stevens sand, confirming the South Area 85-10 KCL discovery well.

In Southwest Texas . . . A new surge of exploratory drilling appears to be sweeping Texas' far southwestern Maverick County, where five new fields were opened last year. The new big-scale wildcatting program is aimed at finding a major producing area in this wide-open, little-prospected region of the state. Since early December of last year 2 dozen wildcats have started drilling in Maverick. Nine shallow tests were given up, but 15 wildcats are now busy searching for production in this northwestern portion of the Rio Grande embayment.

. . . Val Verde strike. A remote, shallow oil discovery was completed 20 miles southwest of Sonora in northern Val Verde County. The 300-ft. wildcat is R. H. Rehders, Jr., 1 Drisdale. Production is from Paluxy (Lower Cretaceous) at 283-395 ft. The well pumped 20 bbl. per day. Location is 9 miles west of Vinegarone-Strawn (Pennsylvanian) field.

In Williston . . . North Dakota continues its lead in Rocky Mountain discovery news. Both the border counties and the southwestern part of the state shared in success.

. . . Renville County. This northern-border county got two new pool prospects, one just south of the Saskatchewan line, the other in the far eastern part of the county's panhandle.

- Gulf Oil Corp. pumped 93 bbl. of oil in 4 hours at its 1 Busch & Nemaha Royalty Co. discovery 5 miles northeast of Bluell field. This border field is a Mission Canyon-Mississippian producer.
- Anschutz Drilling Co. opened another Mission Canyon pool 23 miles southwest of Newburg field, nearest production. The 1 Christensen pumped at the hourly rate of 10 bbl. of oil during tests. Successful completion of this well and Gulf's prospect would give Renville County three oil fields.

. . . Stark County. Atlantic Refining Co. et al. 1 Kadrmas is a Heath sand discovery for Dickinson field in southwestern North Dakota. The well pumped 300 bbl. of oil per day. The field's discovery well was a Madison-Mississippian producer.

. . . Billings County. Scoria field in southwestern North Dakota got its confirmation and second well at Amerada Petroleum Corp. 2 Unit. Production is from both the Heath and the Madison. Flow was 275 bbl. of oil per day from the Heath; 252 bbl. per day from the Madison.

. . . Burke County. Columbus field in northern North Dakota, a 1956 discovery, was confirmed by Tom Schwartz at 1 Ringvald. Production is from the Madison (13 bbl. per hour). This is the third try in the field. The first offset to the discovery well was dry.

Las Animas arch area . . . A Pennsylvanian Lansing-Kansas City oil discovery was completed in Nebraska's far southwestern Dundy County. James M. Cline 1 Rickard pumped 70 bbl. of oil per day. The discovery is about 1 mile southeast of the Jones field discovery well which opened first production in this county.

In Wyoming . . . The first deep test ever to go down in old Grass Creek field in Hot Springs County, Big Horn basin, found oil in the Darwin sand of Amsden or Lower Pennsylvanian age. The well is Ohio Oil Co. 1 pre-Tensleep Unit. Production at Grass Creek is from Tensleep-Pennsylvanian.

In Oklahoma . . . The prolific Laverne and Highland gas districts in northwestern Oklahoma were joined by a Union Oil Co. of California wildcat in

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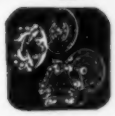
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Harper County. The 1 Riggs found gas in the Hoover sand-Pennsylvanian, linking the two pre-Permian gas areas which cover western Harper and eastern Beaver counties.

In Kentucky . . . Estill Creech et al 1 Robert Gabbard is the first successful wildcat in western Breathitt County, eastern Kentucky, in many years. The well made 125 bbl. of oil per day from Corniferous lime at 1,738-53 and 1,760-65 ft.

In Utah . . . The Paradox basin continues its fast development. The first discovery of 1958 for the Utah side of the basin is Shell Oil Co.'s southwest outpost to Bluff Unit production. The well, located 1 mile southwest of production, flowed 423 bbl. of oil in 4 hours during tests.

In Colorado . . . The Denver basin's Colorado sector seems headed for a revival as a result of one of its best discoveries in some time at West Bijou in Morgan County. The discovery well here made 930 bbl. of oil per day from the Dakota "D" sand. Several operators are busy with offsets. One such well, Williamson-Kissinger 1 Conine, flowed 42 bbl. of oil per hour from the "D" sand, confirming the field.

New Nebraska fields get official labels

EIGHT RECENT OIL discoveries in Western Nebraska have been given field names by the state oil and gas commission body.

All of the new fields are located in the Denver basin portion of the state. New fields are: Chandler, Cheyenne County. The discovery well is Chandler & Simpson 1 Wilson in SW SW NW 19-15n-51w; Panhandle field, Kimball County. O'Donnell & Edmonson opened this one at 1-35 UPRR Panhandle, SE NW NW 35-15n-58w; Schmoeller field, Kimball County.

This one is a Petroleum, Inc., discovery, the 1 Schmoeller in C NW NE 17-16n-55w; Mintken field, Kimball County, opened by British-American Oil Producing Co. at 1 Mintken, C NE NE 2-12n-56w; Frederick pool, Kimball County, opened by Shoreline Petroleum Co. 1 Frederick, C SW NE 31-14n-55w; Rickard field, Dundy County, opened by James M. Cline at 1 Rickard, C SE SW 22-1n-37w; Mather field, Cheyenne County, opened at Raymond Oil Co. 1 Mather, C SW SE 1-16n-52w; and, Jones pool, opened in Dundy County, opened by James M. Cline, at 1 Jones, C SE NW 21-1n-37w.

Triple-pay discovery in British Columbia

Northeastern British Columbia picked up a new gas discovery last week at Texaco-N.F.A. 7 Boundary Lake, 41 miles northeast of Fort St. John. The trizone discovery flowed 11 M.M.c.f. of gas during drill-stem test of the Permo-Penn at 5,020-40 ft. Gas also was found in the Triassic Gething and Bluesky zones. The operators reported 21 ft. of gas pay in the Permo-Penn.

Old Ohio pool gets renewed development

Reese pool has now reached into the corner of four townships of Coshocton County, Tiverton, New Castle, Jefferson and now Monroe Township. Natol Corp. has reported 1 Mary McClain, Lot 33, as making 160 bbl. oil and 760 M.c.f. gas in a 24-hour test after fracture. Clinton sand was logged at 3,382-3,441 ft. and made 40 bbl. natural. Several operators are active in the area extending this old pool which lay dormant for many years.

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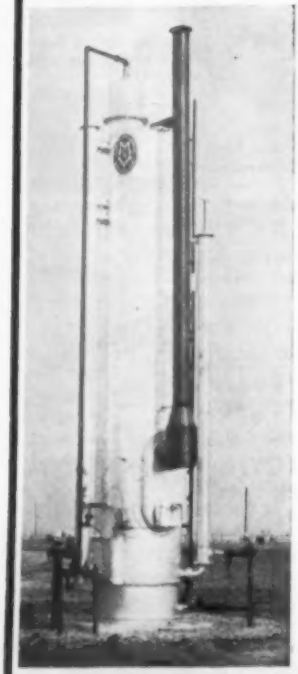

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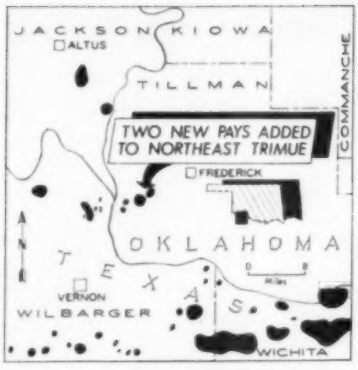

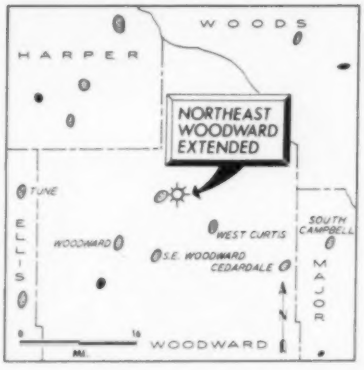

Three Oklahoma counties lead exploratory splurge

TILLMAN

TILLMAN COUNTY in the extreme eastern portion of the Palo Duro basin in far Southwest Oklahoma is busy with development of a new Strawn-Pennsylvanian field at Northeast Trimue. Ambassador Oil Co. released data on two new-pay discoveries in this field last week.

The field discovery well, 1 Oaks, SE SW SE 32-2s-18w, found production in the Strawn conglomerate "A" zone at 4,791-95 ft. That well flowed 153 bbl. per day on 23/64-in. choke. The 1 Oaks was first completed in the "C" zone at 5,026-44 ft. for 180 bbl. per day on 14/64-in. choke after treatment.

Second well in the field, 1 Gibbs, NW NE NE 5-3s-18w, found oil in the "A" zone at 4,775-84 ft.; and also in the "C" zone at 4,999-5,026 ft. A test of the "D" zone got 165 bbl. per day on 14/64-in. choke.

WOODWARD

MORROW SUCCESS at a wildcat 1½ miles east of Northeast Woodward field in Woodward County, northwestern Oklahoma, extended that producing area last week. The new extension success is Sinclair Oil & Gas Co. 1 Phillips in C NW NW 5-23n-19w.

A drill-stem test in the Morrow-Pennsylvanian at 7,428-32 ft. got up to 4,700 M.c.f. of gas per day. Further testing is under way.

Northeast Woodward is one of six gas and gas-distilate fields in the county. The first pool in Woodward was opened southeast of the county seat of Woodward about 2 years ago. Since that time an intense exploratory program has swept across northwestern Oklahoma counties, opening production in Blaine, Ellis, western Major, Woods, Woodward, and Harper counties.

BEAVER

A RANK Beaver County wildcat in the Oklahoma Panhandle is apparently a Checkerboard-Pennsylvanian discovery. The Texas Co. 1 Barby, C NW NW 10-1n-22eCM, between Dower and Elmwood fields in the southwest part of the county, got 4,110 ft. of oil on drill-stem test recovery.

This is the first exploratory success in this section of the county in some time. It opens a new area for the drill near the Texas border in southwestern Beaver County.

The Texas Co.'s new southern Beaver strike moves production and new wildcat territory closer to the fast-growing reservoirs in Ochiltree and Lipscomb counties in the Texas Panhandle. The entire northern tier of the county is blanketed with gas and gas-distillate pools.

PANHANDLE

Pre-Permian Field May Add Oil Production

A Morrow gas-discovery area inside Hugoton gas field in Texas County, Oklahoma Panhandle, appears to have indicated oil production. The possible oil offset discovery is Cities Service Oil Co. 1 Williams-C, SE SE NW 15-4n-15eCM.

The oil prospect flowed 166 bbl. of oil in 3½ hours on ½-in. choke and 2,800 M.c.f. of gas per day from Morrow sand perforations at 6,394-6,410 ft. From 6,419-23 ft. the well previously flowed 96 bbl. of oil in 12 hours and 650 M.c.f. of gas per day.

This new Morrow - Pennsylvanian producing area is in the middle of the county, and in the middle of Guymon-Hugoton field. It is part of the growing checkerboard of pre-Permian fields popping up inside the vast Hugoton gas-field area, both in Texas and in Oklahoma.

NORTHWEST

Northwest Catesby Adds Fifth Producer

Northwestern Oklahoma's Northeast Catesby field has added its fifth producer. The new well in Pan American Petroleum Corp.'s Ellis County field also extends the field 1 mile to the east.

Production tests are under way at the indicated success, 1 O'Hern Unit, C NE SW 33-24n-25w. Gas was found in the Morrow-Pennsylvanian at 8,163-69 ft.

Pan American is also nearing tests at 1 Moyer, C NW SE 19-24n-25w, on the pool's north side. Northeast Catesby was opened last year in the northwest part of Ellis County. Gas production is from the Morrow. The field's discovery revived production in Ellis County, and is a part of the growing "Woodward Trend" play in northwestern Oklahoma.

In Major County . . . Another area in the Pennsylvanian play in this section of Oklahoma is new South Campbell field, Major County.

Pan American made location for the second offset in this Cottage Grove-Pennsylvanian field at 1 Manchester-B, C SE NW 18-22n-15w, east of the discovery well. The same operator is also drilling at 1 Selected Investments in 14-22n-16w, west of the field discovery well.

South Campbell field is in the western part of Major County. Its discovery opened a virgin area of the county for exploration.

Successful Wildcats

UTAH

San Juan County: General Petroleum 14-16 Navajo, 16-40s-25e. IP 110 BOPD, 42.3°, Paradox 6,139-50 ft. TD 6,222 ft.

WYOMING

Fremont County: Phillips-Carter 1 Rolff "A," 26-6n-3w. IPF 296 BOPD, 38° and 26°, Curtis 3,504-54 ft., 3,569-76 ft.; Phosphoria 4,856-4,906 ft. TD 5,507 ft. Opens Rolff Lake pool.

Park County: G. Ross Cabeen & Associates 1 State, C SE SW 2-48n-103w. IP 237 BOPD, 45 BWPD, 14.6°, Phosphoria 5,068-94 ft., 5,104-34 ft. TD 5,272 ft.

Johnson County: D&D Drilling Co. 1 Leiter, C NE SW 21-52n-77w. IP 3½ BOPD, Teapot 6,121-39 ft. TD 6,803 ft. Opens Fortification Creek field.

Sweetwater County: Gaulkins Oil Co. 8-8 Government, C SW SW 8-15n-104w. IP 5,692 M.c.f. of gas per day, Lakota 3,996-4,106 ft. TD 4,222 ft. Rock Springs Uplift.

Laramie County: Wyoming Western 1 Hanson, C NW NW 28-16n-61w. IP 171 BOPD, "J" sand 7,672-91 ft. TD 7,742 ft. New pool.

Sublette County: Belco Petroleum Corp. 2 Unit, SE NW 35-28n-113w. IP 1,715 M.c.f. of gas per day, Frontier 6,896-6,930 ft., 7,286-7,304 ft., 7,344-62 ft., 7,378-7,418 ft., 7,458-74 ft. TD 8,453 ft. Chimney Butte pool.

MISSISSIPPI

Hinds County: Weston Drilling Co. 7 Gaddis Farms, SW NE NE 13-6n-3w. IP 285 BOPD, ⅛-in., 51.2°, GOR 1,000 cu. ft. per barrel, perfs. 11,706-12 ft. (Hosston-Poss). TD 12,211 ft. Elev. 236 ft., Lower Cretaceous 8,040 ft., Hosston 11,254 ft. (New pay in Bolton field.)

SOUTH LOUISIANA

Lafayette Parish: J. P. Owen et al 2 Clement, 11-10s-2e. IP 77 BOPD, 2,418 M.c.f. daily, 5/32-in., 56°, TP 6,600 psi., perfs. 11,308-13 ft. TD 14,410 ft. (Second well and new pay in Southeast Rayne field.)

Lafourche Parish: Union Oil Co. of California 1-L L.L.&E., 39-15s-19e. IP 133 BOPD, 3,850 M.c.f. per barrel, 1/6-in., 50.6°, TP 3,475 psi., perfs. 11,794-11,808 ft. TD 13,500 ft. (New field—west of Raceland field.)

Plaquemines Parish: Tidewater Oil Co. 1-A Cattle Farms, Inc., 21-21s-30e, IP 181 BOPD, 5/32-in., 44.6°, GOR 6,867 cu. ft. per barrel, TP 2,950 psi., perfs. 16,018-60 ft. TD 16,487 ft. (New pay and deepest production in Venice field.)

St. Charles Parish: Anderson-Prichard Oil Corp. and Union Oil & Gas Co. of Louisiana 1 Brady, 31-13s-22e (3½ miles west of Avondale field). IP 114 BOPD and 1,638 M.c.f. daily, $\frac{3}{16}$-in., 54.6°, TP 3,400 psi., perfs. 10,025-27 ft. TD 13,593 ft. (New field—West Avondale.)

St. John the Baptist: F. A. Callery, Inc., 1 Montegut et al, 63-11s-7e (2½ miles southwest of La Place field). IP 187 BOPD, ⅛-in., 35°, GOR 508 cu. ft. per barrel, TP 1,400 psi., perfs. 9,431-35 ft., and (dual completion) 2,800 M.c.f. per day, dry gas, BHFP 3,985 psi., perfs. 9,012-16 ft. TD 11,347 ft. (New field—Bonne Corre.)

SASKATCHEWAN

Coop et al 16-12 Souris River, LSD 16, 12-2-5w2. Charles discovery. TD 5,425 ft.

ALBERTA

Home-Regent 4-20 Swan Hills, LSD 4, 20-67-10w5. Beaverhill Lake oil discovery. TD 8,332 ft.

Anglo Pacific et al 4-36 Hays, LSD 4, 36-11-14w4. Mississippian gas discovery. TD 4,223 ft.

Triad-British American 6-10A Stolberg, LSD 6, 10-42-15w5. Mississippian gas well. TD 13,706 ft.

BRITISH COLUMBIA

White & Lloyd 19 Blueberry, 29-K-94-A-12. Triassic discovery (gas). TD 4,373 ft.

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Ideal for flowing or pumping wells or for well servicing and repressuring projects. Will suspend 2" tubing to 5½" casing up to maximum of 180,000 pounds. Head is full-opening; constructed of pressure cast steel tested to over 4,000 psi. HERCULES original overhead packing arrangement and hinged slips facilitate installation and servicing. HERCULES Neoprene Tubing Stripper (2" - 2½" - 3") may be used in this head on wells flowing intermittently or to wipe tubing. Equipped with safety threads.

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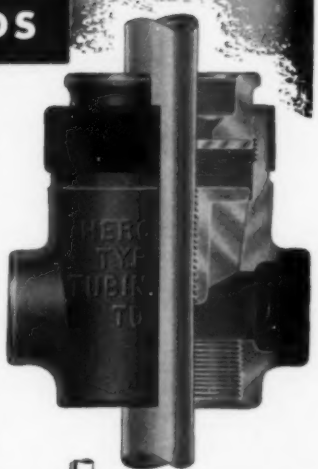
The dual purpose "Type J-5-S" Stripper Tubing Head is basically a "Type J-5" Tubing Head with a bowl (top section) screwed into the packing nut thread. The hinged slips, packing and packing nut are installed in the bowl (top section) with the tubing stripper in the body (lower section), thus permitting tubing to be run-in or removed under pressure. Test pressure is the same as the "Type J-5" Tubing Head.



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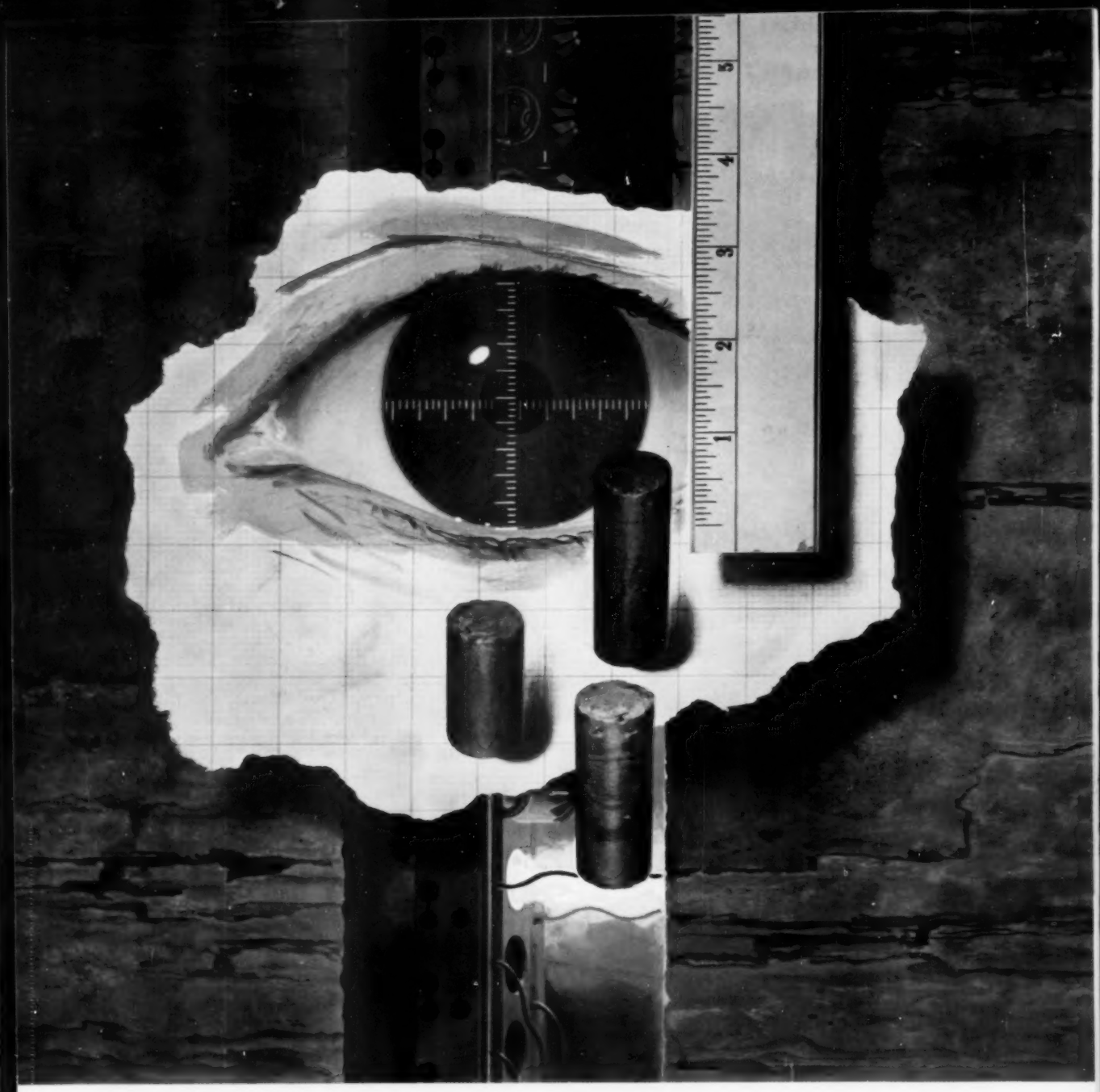

It "threads the needle" at any depth

In hard or soft formations, successful side-wall coring operations can be performed with the Schlumberger Side-Wall Coring Instrument. Up to 30 cores (large enough for a complete core analysis) can be obtained on one trip in the hole.

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THE EYES OF THE OIL INDUSTRY®

SCHLUMBERGER

To keep supports sturdy where maintenance is most difficult, Monel sheathing was applied to this tender type drilling platform during construction by Brown & Root, Inc., Houston, Texas. It is typical of many such structures built by this company.

In tidal zone...hardest to shield... Monel sheathing gives lasting protection against corrosion

Fast becoming standard on offshore structures

THIS drilling platform shows a practice now rapidly becoming universal among large oil companies.

Monel* nickel-copper alloy sheet tightly wrapped about supporting members to protect them from corrosion in the "tidal and splash zone."

Adoption of the nickel-copper alloy sheathing is based upon its actual, on-the-job performance. And in comparison with that of other materials . . . in the hard-to-shield splash zone where water, air and spray attacks fluctuate, leaving piling sometimes wet, sometimes dry.

Monel nickel-copper alloy resists corrosion by salt water, salt air and salt spray. It withstands wave battering and erosive action as well as abuse from floating debris. And it is easily applied by welding.

Usually, 8 to 12 feet of each vertical support is completely sheathed with 18-gauge Monel alloy sheet. With tops, bottoms and seams welded, it protects supports in the critical zone . . . mean tide level to a few feet above prevailing wave crests. Protects diagonal braces and conductor pipe sleeves where necessary, too.

With Monel alloy sheathing, many oil companies extend life of drilling and tank battery barges, well head protector platforms and loading docks.

This nickel-copper alloy sheathing may help prolong life of *your* new structures or those now in water. If you need help with your problem, write to International Nickel.

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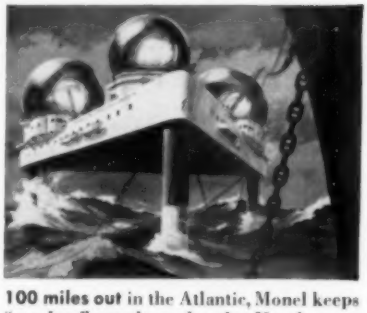

100 miles out in the Atlantic, Monel keeps "sea legs" sturdy under the Navy's man-made islands.

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Monel... *for minimum maintenance*

John E. Swearingen

Frank O. Prior

Prior and Swearingen Advance

. . . at Standard of Indiana as Chairman Wilson retires. New team is strong on production. Swearingen is only 39.

STANDARD OIL CO. (Ind.) has promoted its top command. President Frank O. Prior will be the new board chairman and chief executive officer, and 39-year-old John E. Swearingen will move up from executive vice president to the presidency.

The changes, effective March 19, will follow the retirement of Board Chairman Robert E. Wilson, who is 65 years old.

R. E. WILSON

The new board chairman, third in the history of the company, has been part of the Indiana Standard organization for 37 years and its president since 1955. Prior entered the oil business as a roustabout in 1919 after earning an engineering degree from Stanford University. His employer, Midwest Refining Co., became an Indiana Standard subsidiary in 1921.

Later Prior headed Dixie Oil Co., another subsidiary, and in 1930 became president of Stanolind Oil & Gas Co. (now Pan American Petroleum Corp.).

Thirteen years ago he became a director and vice president in charge of production of Indiana Standard. In 1951 he was elected executive vice president and in 1955 president.

The elevation of Prior and Swearingen was accompanied by two other developments in top management of the company. Robert C. Gunness, an executive vice president since 1956, received additional responsibilities, particularly in coordinating major subsidiaries. George V. Myers, general manager of production, was elected vice president for production.

Wilson's retirement from the board chairmanship does not mean he will be lost to the industry or public life. A widely-known scientist-businessman, he will give more time to his work on the advisory committee to the Atomic Energy Commission and to directorates and trusteeships.

The new president . . . John Swearingen's election as president underlines the "youth movement" in the oil industry. In the past year two other major companies have elected presidents only slightly older than Swearingen. They are C. E. Spahr of Standard Oil Co. (Ohio) and W. H. Morris of Sinclair Oil & Gas Co.

The new Indiana Standard president is an individual for whom the phrases "bright young man" and "dynamic executive" might have been coined. But his 39 years belie his industry experience.

By the time he was 20, Swearingen had earned a B.S. in chemical engineering from the University of South Carolina and a masters degree from Carnegie Institute of Technology. This early start has given him 19 years experience—all of it with Standard and its affiliates—before age 40.

Although he started out in research, at the Whiting, Ind., laboratories, Swearingen is considered a production man. Thus, his election gives the company two production men on the presidential-chairman team.

He moved over to Stanolind in 1947 and became a Stanolind director in 1951. Late in 1951 he became general manager of production for the parent company in Chicago, was elected a director in 1952, vice president in charge of production in 1954, and an executive vice president in 1956.

Knows his business . . . Swearingen is a big husky, athletic-looking individual with handsome features and dark curly hair. He has the soft, deliberate speech characteristic of the southerner. But the slow cadence of his speech does not detract from his articulate, precise, authoritative manner which stems from an obvious intimate knowledge of his company and industry.

R. C. GUNNESS

G. V. MYERS

His main executive talents are the ability to see and resolve a problem quickly, his unusual memory for pertinent details, the capacity for swift action once all the facts are in, and a warm human quality which inspires associates to pull together to get a job done. His extraordinary sensitivity to the feelings of those around him fits him particularly to be a team leader.

An approachable executive, Swearingen is on a friendly first-name basis with many subordinates but loses no dignity in the process.

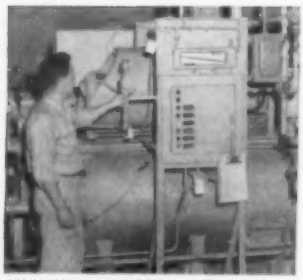
Ben R. Howard, formerly chief geophysicist with Warren Petroleum Corp., has joined Republic Natural Gas Co. as chief geophysicist. He was with Socony Mobil Oil Co., Inc., in Venezuela before joining Warren.

Ford M. Graham, consultant to Monterey Oil Co., has been elected a vice president of the company. He will be senior representative in Louisiana and Mississippi and will direct exploration in those areas.

Interior of Kemp Generator in action

Burned up by inert gas costs?

Come to Kemp



This Kemp 30,000 cu. ft. per hr. Inert Gas Generator meets all purging and blanketing needs at Gulf Oil's Port Arthur plant. Complete safety is assured with the more-than-adequate supply provided by the generator. Refineries everywhere depend on Kemp equipment.

Kemp Inert Gas Generators end the trouble and expense of bottled gas, provide a highly flexible source of supply at a fraction of the cost. With Kemp generators in your operation, you can make liberal use of inerts . . . apply them to the improvement of many other operations. There are Kemp units to manufacture inerts in any quantity, for any application.

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Kemp produced inerts belong in your plant . . . for blanketing, purging, and protective uses . . . agitation of batches during cooking . . . conveying combustibles and controlling reactions.

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Personals

M. A. L. BANKS

M. A. L. Banks, general manger of the British Petroleum Co., Ltd., refineries and technical department, has been appointed a director of BP Trading, Ltd., the parent company's chief trading subsidiary. He succeeds **C. E. Spearing,** who has retired. Banks was appointed general manager of refineries late last year.

O. A. Boatright, plant superintendent for Warren Petroleum Corp. at Holliday, Tex., has been promoted to district superintendent in Houston.

Randolph Bryant, Jr., petroleum engineer in Houston for Gulf Oil Corp., has been promoted to production foreman and transferred to Fannett, Tex.

Bob Nesbitt, geologist in Western Gulf Oil Co.'s Bakersfield, Calif., office, has been transferred to Ventura, Calif., as zone exploration manager. **Gordon Bell,** district geologist in Ventura for Western Gulf, has been transferred to Olympia, Wash.

C. C. Ludwick, division exploration manager for Shell Oil Co.'s Casper, Wyo., division since 1955, has been appointed exploration manager for the Denver area. He will succeed **J. E. Wilson,** who has been promoted to manager of the exploration research section of Shell Development Co.'s new research division. Ludwick, currently on foreign assignment, will take over in Denver in mid-1958.

Howard E. Ford, assistant to the president of Northern Illinois Gas Co. and vice president of NI-Gas Supply Co., has been elected a vice president of Northern Illinois Gas. **Loren W. Tuttle** has been appointed assistant vice president, operations, for the company. **Charles F. Henness** has been named assistant vice president, divisions; **Orville E. Fry,** assistant vice president, industrial relations; and **Randall A. Lightbody,** assistant vice president, management administration. In other appointments, **M. G. Markle** succeeds Tuttle as manager of operations. **C. Joseph Gauthier** becomes assistant manager of operations. **Donald B. Miller** succeeds Gauthier as district manager in the Blue Island-Kankakee district. **Robert J. Eby,** district operating superintendent in the Crystal Lake area, moves up to commercial manager of the central division, replacing Miller. **L. R. Billett** will succeed Eby.

T. S. Kaylor has been promoted by Ohio Oil Co. from foreman in Berwick, La., to superintendent in Stephens, Ark.

Paul S. Ache, Jr., formerly exploitation engineer with Shell Oil Co. in Franklin, La., has joined United Producing Co. in Liberal, Kans., as petroleum engineer.

Truman Odell, drilling superintendent with Webco Drilling Co., has been transferred to Henryetta, Okla., from Ada., Okla.

Carl D. Lang, petroleum engineer with Champlin Oil & Refining Co. in Sinton, Tex., has joined Bright & Schiff as district petroleum engineer in San Antonio, Tex.

John Lee Olsen, assistant director of Sun Oil Co.'s research and development department, has been named assistant director of the research, patent, and engineering departments.

J. R. Brady, formerly with American Louisiana Pipe Line Co., has joined Northern Natural Gas Co. in Omaha, Neb., as reserve engineer in the reserves and availability section, gas-supply department.

O. W. Wade, formerly chief corrosion engineer for Transcontinental Gas Pipe Line Corp., is president of World Supply Co., new Houston firm specializing in corrosion control.

H. O. WOODRUFF

H. O. Woodruff, assistant general manager, domestic producing department, Houston, for The Texas Co., has been promoted to Oklahoma division manager. He will headquarter in Tulsa. Woodruff succeeds **Mark L. Terry,** who has taken early retirement. In other appointments, Texaco has transferred **S. T. McCardell,** assistant Louisiana division manager, from New Orleans to Houston to become assistant general manager, succeeding Woodruff. **J. H. Markley, Jr.,** assistant West Texas division manager, transfers from Fort Worth to Houston, also as assistant general manager. McCardell will be replaced as assistant Louisiana division manager by **J. L. Shea, Jr.,** Louisiana division superintendent of drilling and production. **Tom T. Freeman,** Rocky Mountain division manager will move from Denver to Houston as manager of land evaluations. **O. B. Hocker,** assistant South Texas division manager, will succeed Freeman in Denver. In the South Texas division, Hocker will be replaced by **George H. Clark,** assistant to the general manager. Woodruff, new Oklahoma division manager, has been with Texaco since 1933. He was assistant Pacific Coast division manager in Los Angeles before transferring to Houston in 1956. Terry, retiring manager in Tulsa, joined the company in 1929 when Texaco acquired Josey Oil Co. He took over the Oklahoma division in 1951.

Charles A. Schrader, administrative vice president for supply and transportation with Leonard Refineries, Inc., has been elected president of Leonard Crude Oil Co., a subsidiary of Leonard Refineries. He succeeds the late Del Hewitt, who was killed in a recent airplane crash. Schrader was president of Michigan-Ohio Pipeline Corp. before becoming administrative vice president of Leonard last year. He was also vice president of Mid-West Refineries, Inc., at one time.

Robert J. Kirkpatrick, formerly geologist with Pacific Petroleums, Ltd., in Calgary, has joined Sinclair Canada Oil Co. as geologist.

J. D. Richardson has been transferred by Pan American Petroleum Corp. from Houston, where he was drilling research engineer, to Casper, Wyo., where he will be division drilling superintendent. He succeeds **G. A. Isaacks,** who has been transferred to Fort Worth.

R. H. Erickson, chief geologist of Great Plains Development Co. of Canada, Ltd., has been elected president of the Alberta Society of Petroleum Geologists. Other officers are **William A. Greenwalt, Jr.,** Union Oil Co., vice president; **Pierre E. Cote,** Imperial Oil, Ltd., secretary; **Al R. Keevil,** California Standard Co., treasurer; **W. A. Loucks,** Calgary & Edmonton Corp., Ltd., business manager; **Gil A. Raasch,** Shell Oil Co., editor. **John A. Downing,** Cree Oil of Canada, is immediate past president and will serve on the executive committee with the new officers.

Personals

Fred A. McKinnon has joined Triad Oil Co., Ltd., as exploration manager. He has been exploration manager for Royalite Oil Co., Ltd., since 1949. A graduate of the University of Alberta, McKinnon was with Imperial Oil, Ltd., before joining Royalite.

Roy Chappell, Penrod Drilling Co. tool pusher, has been transferred to Houma, La., from Marshall, Tex.

Horace L. Temple, Felmont Oil Corp.'s production superintendent in Owensboro, Ky., has been promoted to district superintendent in Wichita.

W. C. Tillett, Bellaire, Tex., district exploration manager for Tennessee Gas Transmission Co., has been appointed manager, exploration contracts. He will headquarter in Houston.

Fred M. Springer, mechanical engineer with Magnolia Pipe Line Co. in Dallas, has been transferred to Midland, Tex., as division engineer. **J. B. Goza,** formerly Midland division engineer, has transferred to Houston in the same capacity.

J. F. Jeansonne, superintendent of Humble Oil & Refining Co.'s Bakersfield, Calif., district, has been transferred to the Castaic Junction district in California as superintendent. He replaces **J. E. Cox,** who has been transferred to Bakersfield.

Morton Sterling has moved up from executive vice president to president of Sunset International Petroleum Corp. He succeeds **J. D. Sterling,** who has been named chairman of the board. Sterling was vice president in charge of production before becoming executive vice president.

Robert F. Thurrell, Jr., formerly executive director of IREX, Washington, D. C., has joined Global Enterprises Corp. in Denver as vice president and general manager. Also joining Global are **H. M. Kirkpatrick,** exploitation engineer with Shell Oil Co., and **James R. Muhm,** Phillips Petroleum Co., and **Bennett F. Brock,** formerly with Standard-Vacuum Oil Co. Kirkpatrick will be petroleum engineer with Global. Muhm and Brock are photogeologists.

Thad B. Vance, Michigan district geologist for Panhandle Eastern Pipe Line Co., has been promoted and transferred to Liberal, Kans., as staff geologist.

John A. Moon, engineer in Phillips Petroleum Co.'s rocket-fuels division in McGregor, Tex., has been transferred to Borger, Tex., as engineer in the gasoline department.

Berke L. Thompson has resigned as service engineer for Dowell Incorporated to join Byron M. Finch, oil and gas management, Charleston, W. Va., as staff geologist.

Paul F. Newton has joined Plymouth Oil Co. in Sinton, Tex., as staff reservoir engineer. He was formerly petroleum engineer with Worldwide Petroleum Corp. in Fort Worth.

W. W. Walters, Warren Petroleum Corp., superintendent in Lovington, N. M., has been transferred to Monument, N. M., in the same capacity. **L. A. Walker,** formerly superintendent in Monument, is now Bridgeport, Tex., superintendent.

G. J. Kohler, Jr., manager of Latin American operations for Geophysical Service, Inc., has been named vice president of GSI (Latin America). **Ray H. Wright** has been elected vice president of Geophysical Service International Corp. (Canada).

Frank Pace, Jr., president of General Dynamics Corp. and former secretary of the Army and director of the Bureau of the Budget, has been elected a director of Continental Oil Co. He succeeds the late William V. Griffin.

J. S. COLLINS

J. Spencer Collins has been promoted to exploration manager of Tennessee Gas Transmission Co.'s producing division. He will be in charge of domestic and Canadian operations. **J. M. Browning** was recently appointed overseas exploration manager for TGT. Collins has been staff manager, exploration, in Houston since last year. He joined Tennessee Production Co., subsidiary of Tennessee Gas, in 1952.

Donald L. Barger, superintendent of production and transmission for New York State Natural Gas Corp. since 1955, has been named superintendent of operations.

F. G. D. Muller has retired as vice president of Staytite Co. in Houston. He had been with Staytite for 33 years and was with The Texas Co. and Royal Dutch-Shell companies before that time.

Herbert D. Thornton, former Rocky Mountain division manager for McElroy Ranch Co., has joined Union Carbide Corp.'s petroleum division, general purchasing department, in New York.

Henry Carter Rea, Littleton, Colo., consultant, has accepted an assignment as petroleum adviser to the Government of India. He will return to the U. S. this summer. He is currently at Dehera Dun, India, at headquarters of the Oil and Natural Gas Commission.

DEATHS

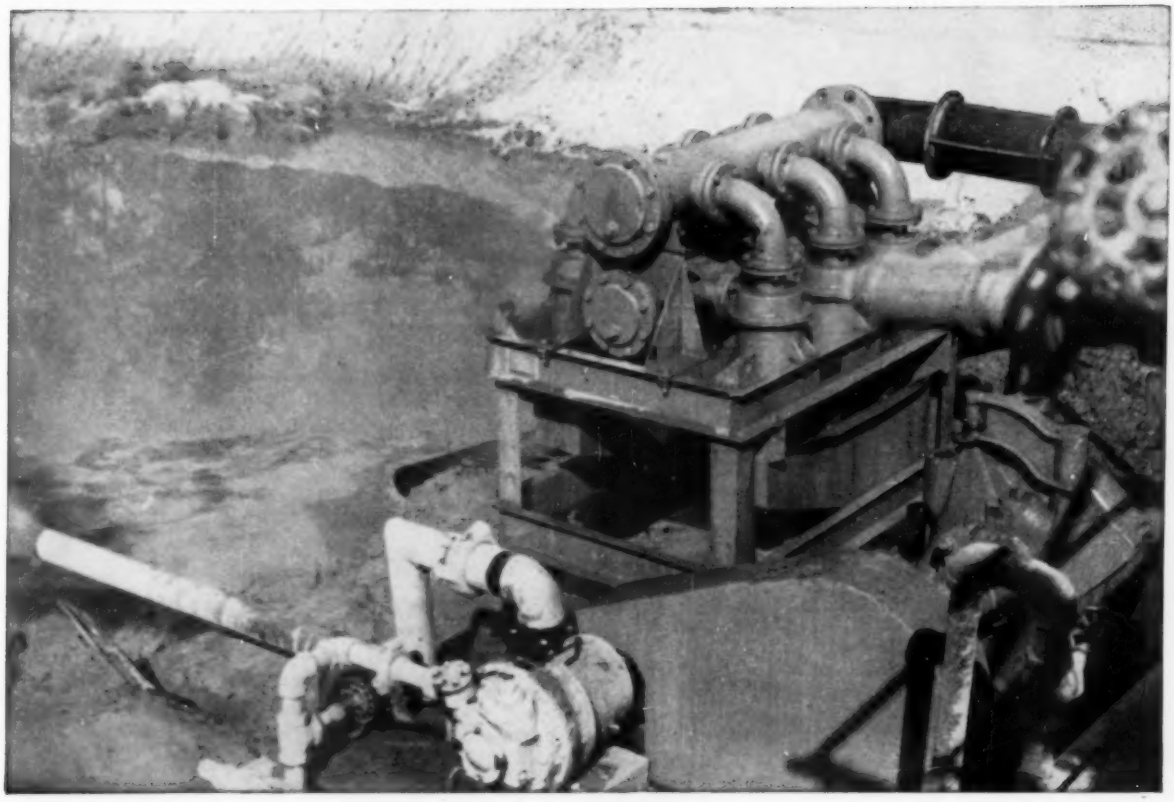
Alexander Hamilton (Ham) Bell, 67, partner in Bell & Burden Drilling Co., Los Angeles, died February 24 in Pasadena, Calif., after a heart attack. Bell had been taken to the hospital the day before with a broken hip. He and **D. H. Burden** organized their drilling company in 1947 with equipment purchased from Continental Oil Co. Bell had previously been in Conoco's drilling department.

R. I. Clark, 65, Abilene, Tex., independent, died February 20 in Abilene. Clark began his career as a roustabout in the Electra oil boom around 1915. He was later a partner in Clark & Cowden Production & Exploration Co.

Eugene William Hansen, 36, Mid-Continent region manager for Shrimpton Manufacturing Co., was killed recently in a two-car collision near Grand Saline, Tex.

Granville C. Berlin, 62, Mount Pleasant, Mich., independent, died February 17.

W. Claude Myers, vice president of Signal Oil Co., died February 20 in Los Angeles.



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GULF COAST

The Dorrco D-Sander was originally developed to remove abrasive sands prevalent in Gulf Coast drilling down to about 9,000 feet. It has worked so well that it is rapidly becoming standard equipment on many Gulf Coast rigs.

On one series of controlled tests, for example, savings in overall drilling costs averaged more than $5,000 per well. Faster drilling rates, reduced pump repair costs and more footage per bit contributed to this saving.

MID-CONTINENT

In North Texas and Oklahoma, build-up of fine drilled solids were increasing viscosity and weight of the drilling fluid and reducing drilling rates.

SWACO Engineers set the D-Sander to remove all drilled solids above 30 microns in size and results were astounding. Drilling rates increased as much as 15 per cent. Bit footage increased as much as 25 per cent and mud control was greatly simplified. Important cost savings were realized.

Regardless of where you drill, the Dorrco D-Sander may save you money by maintaining a low solids, low weight, non-abrasive drilling fluid. For full information, call us.

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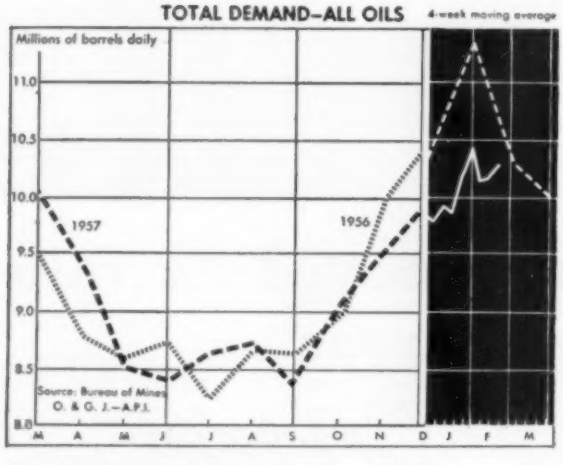
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,829,925	DOWN	33,575	DOWN	908,612
Crude stocks	284,759,000	UP	5,777,000	UP	34,234,000
Completions	928	UP	100	UP	79
Refinery runs	7,506,000	DOWN	14,000	DOWN	289,000
Gasoline stocks	213,659,000	UP	3,099,000	UP	9,537,000
Kerosine stocks	18,596,000	DOWN	1,891,000	DOWN	3,127,000
Distillate stocks	96,668,000	DOWN	11,749,000	UP	8,930,000
Residual stocks	55,435,000	DOWN	1,699,000	UP	19,663,000
Four-product stocks	384,358,000	DOWN	12,240,000	UP	35,003,000
Total imports	1,080,600	DOWN	816,900	DOWN	356,400



Cold weather cut stocks but didn't raise prices

COLD WEATHER in the middle of February took some distress distillate off the market but didn't add much to prices.

In New York Harbor, formal quotations are 9.85 cents a gallon for No. 2 fuel with a discount of 0.2 cent still offered by most suppliers. Local reports on the market indicate that some spot material may be available as low as 9.5 cents a gallon.

Lower temperatures in the New York City area for about 2 weeks in the middle of February raised the accumulated degree-days for the heating season about 2 per cent above last year. However, the total still was about 2 per cent below normal. Mild weather for such a large portion of the heating season from September through January could not be offset by 2 weeks of low temperatures.

The Weather Bureau at the middle of February forecast much-below-normal temperatures for most of the northeastern states through the middle of March. Colder weather in March combined with reduced refinery runs would go a long way toward cleaning up surplus distillate stocks in Gulf Coast and East Coast areas. Good demand in March would tend to prevent additional price cuts.

Esso Standard Oil Co. was the low bidder on 17,000,000 gal. of diesel fuel for the New York City Transit Authority. Esso bid 9.47 cents a gallon. Other bids ranged upward to 11.7 cents, covering deliveries over a period of a year starting in March.

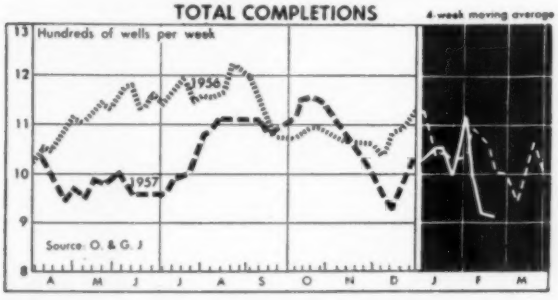
On the Gulf Coast, No. 2 distillate is available for spot sale at 8.25 cents a gallon. The cold weather on the East Coast did not last long enough to create a real shortage of heating oils, so there was no big flood of rush orders for distillate on the Gulf Coast. There were a few reports of suppliers who were looking for distillate on an exchange basis, but no abnormal sales developed on the spot market.

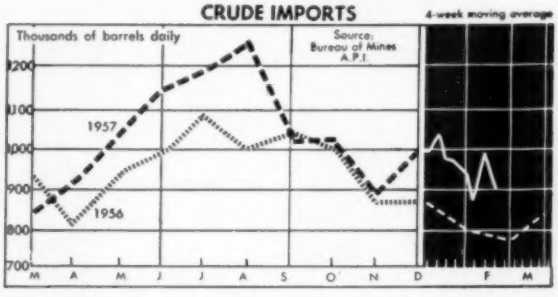
Distillate stocks in District 2 have been near normal for most of the heating season. Stocks were getting low in some pipeline terminals in the second week of the cold period, but the weather broke in time to prevent actual shortages.

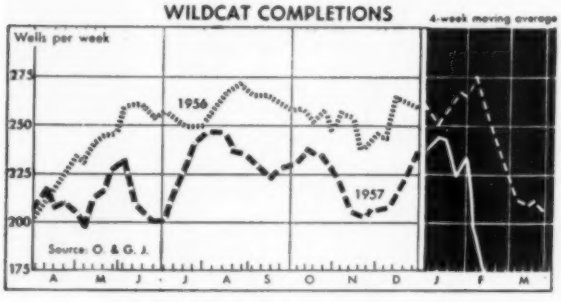
Despite recent sales increases for heavy fuel, there is some indication of softening markets. It starts with the Group 3 market. Some spot sales have been made at less than $1 a barrel for shipment out of Group 3 refineries. Shipments increased when some gas was cut off at electric utility plants during the cold weather, but are back near normal.

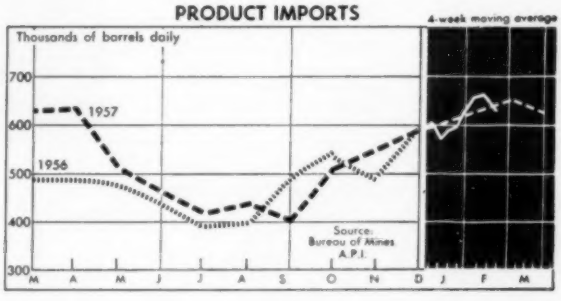
Some Group 3 refiners are shipping residual to the Gulf Coast for a better netback than they can get from normal shipments to northern customers. Unless industrial use picks up on the East Coast, Gulf Coast buyers will be able to get all the fuel they need from local refineries.

Residual prices dropped 10 cents a barrel on the New York market.







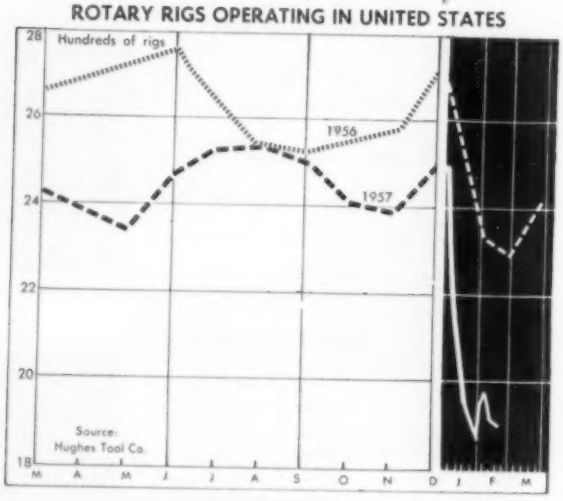


WEEKLY WELL COMPLETIONS . . . WEEK ENDED FEBRUARY 22, 1958

	Total wells							Cumulative		Total wildcats					Cumulative	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1958	1957	Total	Crude	Cond.	Gas	Dry	1958	1957
Alabama	5	4	0	0	1	0	51,359	14	6	1	0	0	0	1	6	3
Arkansas	9	4	0	0	5	0	29,847	111	164	3	1	0	0	2	22	25
California	40	28	0	0	12	0	176,316	311	308	9	1	0	0	8	57	80
Colorado	24	4	0	0	20	0	123,341	108	175	15	0	0	0	15	61	118
Illinois	55	31	0	4	20	0	112,112	311	381	6	0	0	0	6	60	89
Indiana	18	10	0	0	8	0	31,197	99	105	3	0	0	0	3	31	18
Kansas	69	37	0	4	28	0	238,775	571	639	10	1	0	0	9	123	119
Kentucky	12	4	0	4	4	0	22,337	132	230	0	0	0	0	0	15	53
Louisiana	54	27	8	3	16	0	483,226	508	577	5	1	0	1	3	62	104
North	16	9	0	3	4	0	61,321	169	232	1	0	0	1	0	26	28
South	30	11	7	0	12	0	340,578	267	259	4	1	0	0	3	33	64
Offshore	8	7	1	0	0	0	81,327	72	86	0	0	0	0	0	3	12
Michigan	6	2	0	0	4	0	13,815	50	60	3	0	0	0	3	18	26
Mississippi	5	0	0	0	5	0	47,156	69	45	3	0	0	0	3	40	20
Montana	5	2	0	0	3	0	24,315	67	48	2	0	0	0	2	36	17
Nebraska	17	7	0	0	10	0	100,537	101	121	6	1	0	0	5	49	74
New Mexico	39	23	0	6	10	0	196,559	363	309	4	2	0	0	2	59	53
West	21	12	0	6	3	0	104,015	182	116	3	1	0	0	2	28	18
East	18	11	0	0	7	0	92,544	181	193	1	1	0	0	0	31	35
New York	10	5	0	0	0	5	13,500	85	....	0	0	0	0	0	5	.....
North Dakota	15	8	0	0	7	0	107,209	66	51	7	1	0	0	6	24	19
Ohio	22	10	0	8	4	0	57,339	137	145	0	0	0	0	0	3	3
Oklahoma	120	51	5	6	56	2	441,446	1,113	1,059	19	0	2	2	15	162	124
Pennsylvania	1	0	0	1	0	0	8,152	17	*45	1	0	0	1	0	2	*17
Texas	351	180	11	20	138	2	1,478,082	2,914	3,429	89	6	3	1	79	629	988
District 1	24	10	0	1	13	0	56,202	145	181	12	2	0	0	10	62	72
District 2	6	2	0	1	3	0	37,750	89	111	2	0	0	1	1	24	53
District 3	19	15	0	0	4	0	107,134	201	300	2	0	0	0	2	33	102
District 4	18	2	3	0	13	0	92,236	189	226	8	0	0	0	8	65	89
East	28	13	3	0	12	0	119,253	219	205	7	0	0	0	7	59	58
District 7-B	51	18	2	0	30	1	177,689	359	475	17	2	1	0	14	116	186
West	102	69	2	2	28	1	571,390	868	892	22	1	1	0	20	139	150
District 9	74	37	0	4	33	0	200,426	634	805	16	0	0	0	16	111	254
District 10	29	14	1	12	2	0	116,002	210	234	3	1	1	0	1	20	24
Utah	10	8	0	1	1	0	54,533	67	22	1	0	0	0	1	11	12
West Virginia	29	8	0	14	7	0	81,506	121	109	1	0	0	0	1	4	8
Wyoming	11	7	0	1	3	0	50,299	114	129	3	1	0	0	2	47	49
Miscellaneous (Ariz.)	1	0	0	0	1	0	2,303	21	14	1	0	0	0	1	16	8
Total U. S.	928	460	24	72	363	9	3,945,261	7,470	8,171	192	15	5	5	167	1,542	2,027
Total prev. week	828	440	17	70	274	27	3,608,487	.....	.....	149	18	3	6	122	.....	.....
Cum. 1958	7,470	3,728	174	569	2,845	154	31,526,008	.....	.....	1,542	138	21	64	1,319	.....	.....
Western Canada	50	30	....	5	15	0	246,895	353	341	20	4	0	2	14	116	82

*Incl. New York.

ROTARY RIGS OPERATING IN UNITED STATES

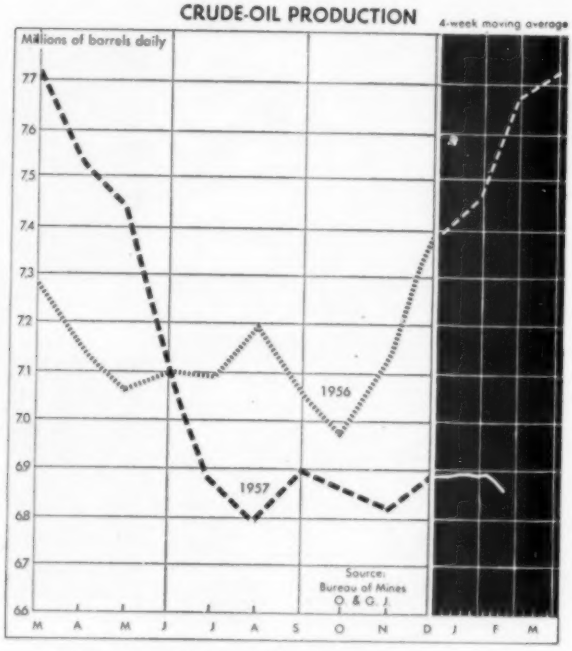


ACTIVE ROTARY RIGS*

	7-24-58	2-17-58	2-10-58	2-25-57
Alabama	7	8	10	9
Arkansas	22	22	16	17
Arizona	1	1	1	..
California	85	82	87	96
Colorado	26	37	36	41
Florida	2	1	1	2
Georgia	..	..	..	..
Idaho	..	..	..	1
Illinois	47	42	37	43
Indiana	7	5	4	4
Iowa	3	3	3	1
Kansas	117	121	124	152
Kentucky	4	9	2	7
Louisiana	327	325	326	451
North	30	31	29	50
South	231	232	231	291
Offshore	66	62	66	110
Maryland	..	..	..	1
Michigan	9	9	9	13
Missouri	..	..	..	..
Montana	26	27	26	25
Mississippi	40	41	47	21
Nebraska	19	20	17	28
Nevada	..	..	..	..
New Mexico	109	108	114	111
New York	1	1	1	..
North Dakota	29	34	33	19
Ohio	1	2	2	..
Oklahoma	182	186	205	232
Oregon	..	..	..	1
Pennsylvania	10	12	11	14
South Dakota	..	..	..	2
Texas	727	718	773	950
Gulf Coast	153	154	164	223
Offshore	2	4	4	6
West	305	304	314	354
North	223	209	250	310
East	44	44	41	57
Tennessee	..	..	..	..
Utah	42	40	40	34
Washington	..	..	..	1
West Virginia	4	4	4	1
Wyoming	50	53	53	49
Virginia	..	..	..	..
Total United States	1,897	1,911	1,982	2,326
Western Canada	237	241	214	254
Eastern Canada	..	..	..	..
Grand total	2,134	2,152	2,196	2,580

*Hughes Tool Co.

CRUDE-OIL PRODUCTION

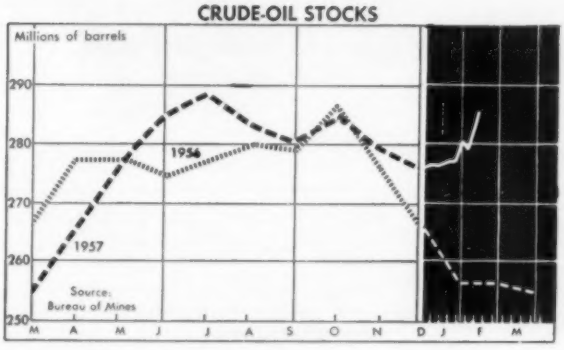


DAILY AVERAGE PRODUCTION FOR WEEK

	February 22, 1958			Feb. 15
	Crude oil	Lease condensate	Total	total
Alabama	15,925	.....	15,925	15,800
Arkansas	83,425	200	83,625	83,650
California	897,300	.....	897,300	902,000
Colorado	141,550	.....	141,550	138,600
Eastern	49,600	.....	49,600	50,900
Florida	1,275	.....	1,275	1,275
Illinois	232,500	.....	232,500	235,700
Indiana	31,200	.....	31,200	30,900
Kansas	†331,350	.....	†331,350	†334,650
Kentucky	40,500	.....	40,500	41,200
Louisiana	755,450	95,600	851,050	855,500
North	105,650	2,300	107,950	112,400
South	649,800	93,300	743,100	743,100
Michigan	26,400	.....	26,400	26,400
Mississippi	98,900	4,950	103,850	103,850
Montana	74,300	.....	74,300	75,200
Nebraska	54,100	.....	54,100	54,575
Nevada	150	.....	150	150
New Mexico	260,150	5,900	266,050	265,000
North Dakota	37,050	.....	37,050	33,850
Oklahoma	†547,500	.....	†547,500	†569,800
Texas	2,660,000	62,150	2,722,150	2,722,150
Dist. 1	48,000	475	48,475	48,475
Dist. 2	122,000	9,125	131,125	131,125
Dist 3	371,000	31,000	402,000	402,000
Dist. 4	199,000	7,500	206,500	206,500
Dist. 5	35,000	500	35,500	35,500
Dist. 6	122,000	7,000	129,000	129,000
East Texas Field	164,000	.....	164,000	164,000
Dist. 7-B	148,000	150	148,150	148,150
Dist. 7-C	143,000	3,650	146,650	146,650
Dist. 8	1,000,000	1,500	1,001,500	1,001,500
Dist. 9	201,000	600	201,600	201,600
Dist. 10	107,000	650	107,650	107,650
Utah	14,750	.....	14,750	15,200
Wyoming	307,550	.....	307,550	306,950
Others	‡200	.....	‡200	‡200
Total U. S.	6,661,125	168,800	**6,829,925**	6,863,500
Change from prev. week, down	.....	.....	**33,575**	
Canada	†528,960	.....	†528,960	†514,900
Total U. S. production—Jan. 1-Feb. 22	.....	.....	364,312,315 bbl.	
Same period last year (crude plus cond.)	.....	.....	*400,718,774 bbl.	

*Includes 7,765,250 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



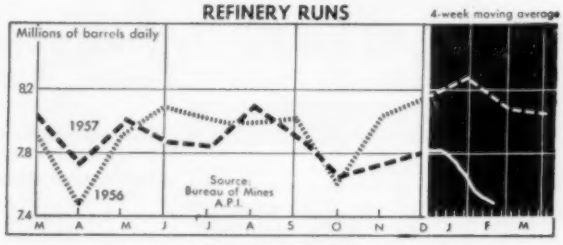
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

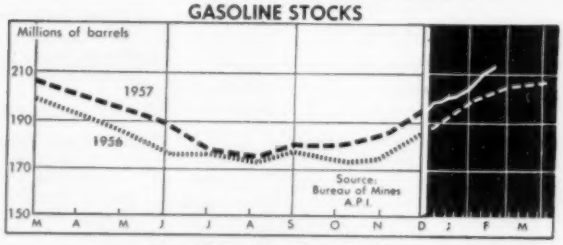
	2-15-58	2-8-58	2-16-57
Pennsylvania Grade	2,805	2,956	2,384
Other Appalachian	1,527	1,573	2,065
Illinois, Indiana, and Michigan	11,380	11,457	10,071
Nebraska and North Dakota	2,413	2,520	2,192
Kansas	9,602	9,587	9,188
Oklahoma	18,838	18,940	20,955
Arkansas	2,964	2,610	2,279
Louisiana	20,234	19,927	18,903
North	3,332	3,065	2,825
South	16,902	16,862	16,078
Mississippi, Ala., and Fla.	2,699	2,816	2,061
New Mexico	9,344	9,197	7,423
Texas	124,829	123,026	112,685
East Texas	9,500	9,469	9,861
West Texas	55,164	53,757	52,886
Texas Gulf	26,629	26,085	21,399
Other Texas	33,536	33,715	28,539
Wyoming	14,442	14,141	15,518
Other Rocky Mountains	7,028	6,716	6,028
California	38,000	37,386	27,475
Foreign	†18,654	16,130	11,298
Total	284,759	278,982	250,525

*Bureau of Mines. †Includes 5,922,000 bbl. in California.

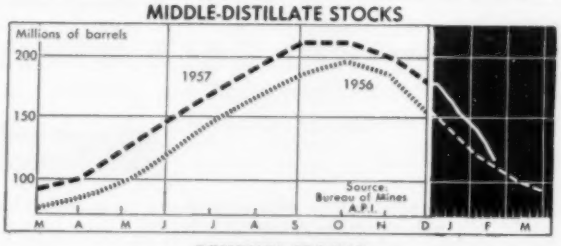
REFINERY RUNS



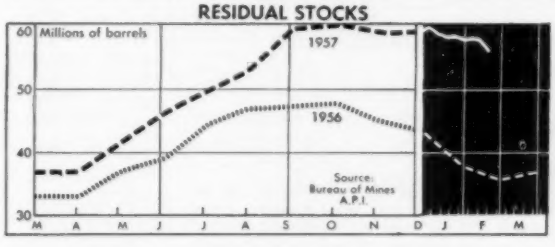
GASOLINE STOCKS



MIDDLE-DISTILLATE STOCKS



RESIDUAL STOCKS



API REFINERY REPORT—FEBRUARY 21, 1958

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, February 1957 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,107	426.7	23.4	319.0	182.1	43,184	7,769	33,802	10,432	1,176	479.2	39.9	333.5	212.6
Appalachian:														
District 1	97	35.0	6.3	24.9	11.7	5,411	470	2,086	583	100	39.3	6.1	24.2	8.0
District 2	108	52.7	6.1	16.3	13.6	2,964	316	571	454	111	56.9	7.1	21.7	16.6
Ind., Ill., Ky.	1,428	718.4	77.7	330.0	198.4	38,944	3,895	12,380	4,459	1,466	706.1	71.3	340.2	209.8
Minn., Wis., Dak.	110	50.4	6.9	28.4	15.6	7,102	682	4,433	340	103	50.5	6.3	27.0	12.0
Okla., Kans., Mo.	720	390.3	18.3	183.3	42.1	20,864	807	6,853	1,048	689	379.9	15.0	172.5	44.8
Inland Texas	275	201.4	8.3	53.6	26.9	8,930	332	1,492	2,090	270	186.5	7.9	51.7	23.0
Texas Gulf Coast	1,689	819.3	124.2	445.4	206.0	30,571	1,612	10,657	5,337	1,945	879.9	121.5	580.5	242.6
La. Gulf Coast	598	363.3	53.1	136.1	32.7	13,407	968	5,205	1,186	685	329.5	62.0	207.2	52.7
N. La. and Ark.	79	38.7	4.4	14.9	5.3	5,170	1,053	1,912	90	96	37.1	7.3	25.9	7.0
Rocky Mountain:														
New Mexico	29	14.6	1.0	7.0	3.6	372	45	138	85	28	14.3	0.5	5.2	3.5
Other Rocky Mtn.	257	128.0	2.3	54.8	30.7	7,512	259	2,644	894	286	135.1	2.5	68.4	42.3
West Coast	1,009	466.4	6.0	101.7	341.2	29,228	388	14,495	28,437	1,133	494.6	5.2	176.6	394.6
Feb. 21, 1958	7,506	3,705.2	338.0	1,715.4	1,109.9	213,659	18,596	96,668	55,435	8,088	3,788.9	352.6	2,034.6	1,269.5
Feb. 14, 1958	7,520	3,794.1	374.1	1,708.7	1,087.9	210,560	20,487	108,417	57,134	.....	.....	.....	.....	.....
Feb. 22, 1957	7,795	3,667.6	331.1	1,979.7	1,235.9	204,122	21,723	87,738	35,772	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (89 octane)	11.25-11.75
Premium (98 octane)	14.00-14.50
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.00-10.50
Regular (92 octane)	10.25-10.50
Premium (97 octane)	11.75-12.00
Premium (98 octane)	12.00-12.50
California (rack) (Los Angeles):	
Regular (88 octane)	12.2
Premium (96 octane)	14.5
Premium (98 octane)	15.0
Caribbean area (cargoes):	
Regular (87 octane)	9.875
Premium (93 octane)	10.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:	
Grade 26-70	4.5
Breckenridge:	
Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	9.50-9.75
Diesel oil (58 d.i. and above)	9.125-9.50
Distillate No. 1	9.125-9.50
Distillate No. 2	8.50-8.75
Gulf Coast (cargoes):	
Kerosine 41-43	8.50-8.75
Distillate No. 2	8.25-8.50
New York Harbor (barges):	
Kerosine 41-43	10.35
Distillate No. 2	9.65-9.85
Diesel fuel, 48-52 d.i.	10.25
Caribbean area (cargoes):	
Distillate No. 2	8.50

WAX (LB.)

Oklahoma (Group 3):	
132-135 A.m.p. (semi-refined) in tank cars	6.50
New York (export):	
126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.15-1.30
Gulf Coast (cargoes):	
Bunker C fuel	$2.25-2.50
New York Harbor (barges):	
★ Bunker C fuel	$2.65
Caribbean (cargoes):	
Bunker C	$2.35
California (rack):	
Bunker C fuel, Los Angeles	$2.65-2.80

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	27
200 vis. neutral (180° at 100°), 25 p.t.	25

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour) (§)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.81
16-16.9	2.74	....	....	....	1.86
17-17.9	2.78	....	....	....	1.91
18-18.9	2.82	....	....	....	1.96
19-19.9	2.85	....	....	....	2.01
20-20.9	2.89	$2.75	....	$2.62	2.06
21-21.9	2.93	2.77	....	2.64	2.11
22-22.9	2.97	2.79	....	2.66	2.16
23-23.9	3.01	2.81	$3.44	2.68	2.21
24-24.9	3.05	2.83	3.46	2.70	2.26
25-25.9	3.09	2.85	3.48	2.72	2.31
26-26.9	3.13	2.87	3.50	2.74	2.36
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, part of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low cold test Gulf Coast. ‡Sour. §Some heavy Wyoming sour posted at 8 cents less.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, July 26, 1957.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.65
Middle District	4.47
Southwest Pennsylvania	4.18
West Virginia	4.00
Buckeye Grade	4.00
Illinois Basin	3.00
Canada:	
Leduc-Woodbend	2.74
Redwater (Alta.)	2.63
Smiley (Sask.)	2.40
Pembina	2.61

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 41°-41.9°, Puerto La Cruz	3.34
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.25-2.38
Bachaquero, flat, Las Piedras*	2.03-2.18

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Abadan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9, Umm Said	2.23
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., dirty (USMC—32.5%)	$1.92
Gulf-U.S.N.H., clean (USMC—10%)	2.57
Carib.-U.S.N.H., dirty (USMC—55%)	1.22
★ Carib.-U.S.N.H., clean (USMC—10%)	2.43

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PUMPS: 1—5x10 Worthington powered by 6MZ, 1—5x10 FXOFXO powered by WAKU, 1—7¼x14 Bethlehem on skids, 1—7¼x12 Oil Well, 1—4" Jaeger Centrifugal, 1—Power driven Halliburton measuring device, 1—85 CU gas driven air compressor, 1—Brewster OBL 12 Rotary. List your surplus equipment with us. P. O. Box 814, Phone MI 5-3318, Houston, Texas.

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1—Worthington 155 HP, 300 lb. WP.
2—Worthington 100 HP, 500 lb. WP.
2—Worthington 60 HP, 300 lb. WP.
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All sizes new packaged units 25 to 750 HP, belt driven, angle frames, and direct driven rotary. Call us for your cylinder requirements.
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Carson Machine & Supply Co.

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MElrose 4-0511

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NATURAL GASOLINE PLANT,

4" Vacuum to 550 P.S.I. discharge, Total Compressor H. P. 3,295. TOPPING PLANT, complete, 3,000 barrels per day with approximately 170,000 gallons Pressure Storage and 21,350 barrels of other storage. All Equipment may be inspected; inventory furnished upon request. All bids will be subject to Plant Site Lease Agreement and bids must be accompanied by cashier's check for 5% of the total bid and presented personally at First State Bank of San Diego, Texas. For further information, write or call

EARL DELANEY,
P. O. BOX 567,
TELEPHONE 10,
SAN DIEGO, TEXAS

FOR SALE EQUIPMENT

FAILING—Rotary Rig—Capacity 2500 Ft. 2900 Ft. 2⅞ in. x 30 ft. drill pipe, top grade, with new tool joints. Gardner-Denver Pump 5 x 10 skid-mounted. 3—30 ft. drill collars. Hughes core barrel. This rig too large for our needs. Price $20,000. Would consider top grade 1500 ft. at actual value—balance—cash. Hobert Betz—Lane, Kansas—Phone 39.

FOR SALE EQUIPMENT

U-34 DRAWWORKS Serial #68 with WAK engine Serial #732489 and Torque Converter Serial #90642. Price $15,000.00. 127' Lee C. Moore Mast Serial #T-797 with 5½' x 34' substructure and 16" sub-base, extension braces, etc. Price $11,600.00. All located near Tulsa. Box K-524, The Oil and Gas Journal, Tulsa, Oklahoma.

OVER $150,000

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NEW—1,155—¾" x 16' Type 304, 18 Ga. Stainless Steel Heat Exchanger Tubes—$10.28 each.
NEW—Valves, Fittings, Boiler Tubes, Bolts, etc.
USED—Towers, Absorbers, Pumps, Motors.

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4—**NEW** 22" x 12" SVG, Ser. #32-9979, 83, 87 and 91, 60 psig W.P.
2—**NEW** 12½" x 12" SVG, Ser. #32-9980 and 84, 200 psig W.P.
2—15½" x 12" XVG, Ser. #1T245 and #1T246, Type 60K, 125# W.P.
1—10" x 12" XVG, Ser. No. 3T . , Type 54K1E, Type 54K2E, 250# W.P.
1—14" x 12" XVG, Ser. #3T2373, Type 67K1EC, Type 67K2EC, 150# W.P.
1—8½" x 14", Imperial, Type 10, Ser. #1X716, 800# W.P.
2—29" x 15" LVG, Ser. #2T220 and #2T221, Type 104K, 75# W.P.
4—9¼" x 12" XVG, Ser. #3T415, #3T416, #3T417 and #3T418, 250# W.P.
2—14" x 14" XOB, Ser. #51113-7715, 75# W.P.

COOPER-BESSEMER COMPRESSOR CYLINDERS

1—8" x 14" Ser. #12489, Class C5A14, Suction 200#, Discharge 500# Ga.
1—8" x 14" Part #C52-14-DK, Class C5A, Ser. #12488. (Cylinder Liner)
1—8" Piston, Part #CA-24-EK for Cooper-Bessemer, Class C5A.
2—23½" x 14" Ser. #4730 and #4731, Class CE14, Suction 0#, Discharge 40#.
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2—14" x 36" **SNOW COMPRESSOR CYLINDERS**, 325# W.P.
5—PRACTICALLY NEW 3¾" x 8¼" Cast Iron **CLARK COMPRESSOR CYLINDERS**, Ser. #MA1550-51-53-54-55.

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TANKS & TOWERS

14' x 21' x 1" Shell, Steel
12' x 43' x ⅜" Shell, Steel
8½' x 19' x ¼" Shell, T-316SS
14" x 40' Tower, 160#
18" x 23' Tower, 160#
24" x 28' Tower, 550#

8' x 75', 28 Tray, 25#
5' x 90', 40 Tray, 135#
24" x 45', 24 Tray
18" x 32', 15 Tray, 160#
12" x 27', 20 Tray, 450#
24" x 42', 22 Tray, 230# T-304SS
18" x 23', 11 Tray, 200# T-316SS
30" x 20', 8 Tray 50# T-304SS

Valves: Steel & SS ½" through 6"
Furnaces: Petro-Chem, ½, ¾ mil. BTU-HR.

HEAT EXCHANGERS

Steel Tube: 1000, 900, 650, 500, 300, 200 sq. ft.
Adm. Tube: 2250, 2200, 1300, 900, 740, 625, 300 sq. ft.
S.S. Tube: 1228, 947, 570, 536, 380, 315, 250, 157 sq. ft.
4-6% Chr. Tube: 1000, 500 sq. ft.
Fin Tube: 73, 21, 11 sq. ft.

PUMPS

Hot-Oil: 324 gpm @ 4600'; 735 gpm @ 3100'; 400 gpm @ 2000'; 1270 gpm @ 400'.
Water: 10,500 gpm @ 135'

COMPRESSORS

Worth.: LTC-6, Gas Engine, 800 hp.
Penna.: 100 CFM @ 500#; 385 CFM @ 150#

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FOR SALE at Bartlesville, one Mayhew 1000 heavy duty all purpose drill 5"x6" Wheatley pump, 23' Kelly, 25' mast mounted on 1951 Ford truck, 6 cylinder, 158" chassis. Unit bought new November 1946, truck March 1951. Price $6500.00. Cities Service Oil Company—Patridge, Bartlesville.

SERVICE COMPANY EQUIPMENT—Wichtex C-60 and C-65 double drum mounted units, three pickup trucks, light plant and complete tools $25,000.00. May be inspected in operation, Novice, Texas, Phone 363, or Fort Worth, ED 6-3788.

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NEW CASING AND TUBING

4½"	F-25, 9.5# LW	52,000'
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5½"	J-55, 14 & 15.5# EW	12,000'

CORNELL OIL COMPANY
Attn.: L. C. SPENCER
P. O. Box 246
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FOR SALE EQUIPMENT

MAYHEW SHOT HOLE Drill and Drill Tender. Good condition. Sacrifice. Tom Purcell, 2220 Adolphus Tower, Dallas, Texas. RI 2-4257.

1—750 FOOT DRILLING RIG with drill pipe etc., float mounted. Trade for Cabin Cruiser Boat, acreage or cash. P. O. Box 814, Phone MI 5-3318, Houston, Texas.

25,000 Feet
16" OD
USED GAS LINE PIPE
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ONE WILSON MOGUL SPUDDER, with telescoping steel mast. 3 WAK Waukesha Engines—Excellent condition. One Ingersoll-Rand XVG 150 H.P. Gas Compressor. One Ingersoll-Rand 500 H.P. 8 cylinder in-line diesel engine. Two 125 KW Generator Sets. One 50 KW Generator Set. Box 351, Salem, Illinois.

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Submergible Tank Barge, 48' x 60' x 5' fresh water filling system barge with 48' x 48' x 13'—4-compartment 5000 bbl. oil storage, 500# W.P. Two stage separation, gas metering equipment—12 well header submerging equipment, cathodic protected—good condition.

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TIDEWATER OIL CO.—DRUMRIGHT, OKLA.—NEW 1950

2 PETRO-CHEM Iso-Flow Furnaces. 19 & 25 Million BTU/hr.

FINES SEPARATORS, Centrifix 16" type RVD
FRESH CATALYST ELEVATOR, 72' cc, 8" x 5" Buckets.
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Fines Storage, 6'0" ID x 10'6".
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Drums & Receivers: 8'0" x 28'9"; 6'0" x 14'0"; 5'0" x 14'0"; (3) 4'6" x 16'0"; (2) 4'0" 12'0".

PEABODY Direct Fired Air Heater, 10,000 SCFM.

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8'0" x 75'0"	25 PSI 4 Baffle & 22 Bubble Cap Trays
6'0" x 30'0"	50 PSI 9 Trays
5'0" x 58'0"	50 PSI 26 Trays
3'0" x 45'0"	260 PSI Packed
3'0" x 32'0"	40 PSI 8 Bubble Cap St Steel Trays
3'0" x 23'6"	600 PSI Packed
2'6" x 77'6"	275 PSI 32 Bubble Cap St Steel Trays
2'6" x 43'6"	180 PSI 24 Bubble Cap Trays
2'6" x 30'0"	270 PSI Packed

REGENERATION AIR BLOWER, 11,000 CFM, 11 PSIG, Turbine Driven.

REBOILERS

All Steel U-Tube Bundles, Sq. Ft. Area: 947; 705; 220; 165.

POMONA PUMPS

GPM	PRESSURE	DRIVE
2600	75 PSI	200 HP Motor
2600	75 PSI	160 HP Turbine
1550	75 PSI	125 HP Motor (2)
680	65 PSI	40 HP Motor

COOLING TOWER FLUOR INDUCED DRAFT, 6750 GPM, Three Cell Unit.

HEAT EXCHANGERS - CONDENSERS

Steel Tube (8) 170, 705, 880, 1060, 1500 Sq. Ft.
Adm. Tube (18) 331, 540, 705, 948, 1060, 1750 Sq. Ft.
CUPRO-NICKEL Monel Clad Shell 1495 Sq. Ft. (6)
BROWN FINTUBE, Steel Shells & Tubes 600 PSI 600° F. 68 from 92 to 158 Sq. Ft.

BLOW DOWN DRUM & STACK, 8'0" ID x 17'0", STACK 18" Dia. x 110" High.

KILN 18'-6¼" ID x 55'8" OA

BYRON JACKSON CENTRIFUGAL PUMPS

1 Motor & 1 Turbine Driven

(4) 1½" x 2" Two Stage (8) 2" x 3" (4) 3" x 4" (4) 1½" x 2½" Two Stage (2) 4" x 6"

REACTOR, Stainless Steel Lined, 14'0" ID x 44'2" OA

DUPLEX & SIMPLEX STEAM PUMPS

12 x 5 x 12 (2)
8 x 4½ x 12 (2)
8 x 4 x 6 (5)
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Hot Oil 6 x 4 x 6 (3)

INSTRUMENTS, complete instrumentation for control of all steps in process—Write for complete list.

PASSENGER ELEVATOR—Otis Electric 6' x 6', Travel 182'6" 10 Opening stops same side. Rate of Travel 300 FPM, Capacity 2500 lbs.

OTHER MODERN EQUIPMENT OFFERED AT TREMENDOUS SAVINGS,

PROPANE GAS DEHYDRATOR, 20,000 gals./day, Type EXHC SX Anders Fully Automatic dual tower.

AGITATOR TANK, 50,000 gal. capacity.

ETHYL BLENDING PLANT, 8,500 gallon—60 Ton Howe Weight-O-Graph.
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FURNACE TUBES—4" x ⅝" x 24'8"—Croloy 5, NEW; 4½" x ⅞" x 29'6"—Croloy 5, USED; 5" x ¾" x 19'6"—Croloy 5, USED.

750 Ton Good Used Steel Pipe, 2" to 18".

200 Ton Flanges, Fittings, Valves, Steel & Cast Iron, Used.

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WELDED	RIVETED
80,000 bbl. Floating Roof	55,000 bbl. Cone (2)
80,000 bbl. Open	10,000 bbl. Cone (2)
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5,000 bbl. Cone (3)	2,500 bbl. Cone
1,800 bbl. Cone (2)	1,800 bbl. Cone (12)
1,500 bbl. Cone (2)	1,500 bbl. Cone (2)
	1,000 bbl. Cone (6)

10,000 Bbl. Welded HORTON SPHEROID

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FOR SALE at our Oklahoma City warehouse—one used type M-6-H-72" ID x 22'6" Maloney-Crawford horizontal emulsion treater, also, one used type 4992-2 Bettis Steamer, 300# maximum SWP, lot price $3,000.00. Patridge—Cherokee Pipe Line—Bartlesville, Oklahoma.

FOR SALE at our Chase and Russell, Kansas warehouses, 2—Model CD and 1—Model AB National Tank Portable Batch Treaters mounted on skids. Cities Service Oil—Patridge, Bartlesville.

ROYAL SCINTILLATOR, Model 118. Excellent for uranium prospecting, radioactive survey for oil fields and fault line tracing. Good condition. Two-thirds original purchase cost. Joseph Kesl, Box 164, Edwardsville, Ill.

1 GMC PERFORATING TRUCK, complete with Gamma Ray logging equipment. 20,000' line capacity. Perfect condition. Will sell with or without logging equipment and line. Box K-487, The Oil and Gas Journal, Tulsa, Oklahoma.

1 36L BUCYRUS Spudder complete with 5 and 7 inch tailing in tools. Dog house, butane tank, junk rack and light plant. Rod and tubing tools and hand tools. Phone Office 144, Res. 614, Cleveland, Oklahoma.

WALKER-NEER SPUDDER—Model S-43. New Lines, 5" and 6" tools. Complete equipment for completion work.—Bandy Drilling Company, Cushing, Oklahoma.

CLARK MODEL HMA-4 gas engine driven skid mounted (packaged) compressor with 175 HP, two stage, $3\frac{1}{4}$" and $2\frac{5}{8}$" by $8\frac{1}{4}$" compressor cylinders, 400 PSI suction, 2900 PSI discharge, 59,000 SCFH, unused, contact Demse, Lowell Gas Co., Lowell, Mass.

1—ALLIS-CHALMERS HD15 Diesel Tractor with Baker 15X Hydraulic 8' Bulldozer, Carco Winch, 1300 operating hours. 1—4x5 Piston Type Water Pump. 1—$10\frac{3}{4}$x$4\frac{1}{2}$ McEvoy Blow out preventer. 1—Set 2RCS Baash-Ross $4\frac{1}{4}$ Roller Drive Bushings. 1—Set $3\frac{1}{2}$x$10\frac{3}{4}$ Type C Web Wilson Rotary Tongs. 1—Set $4\frac{1}{2}$ Mission Rotary Drill Pipe Slips. 1—$17\frac{1}{4}$ Surface bit. 1—60 Barrel Steel Tank on Skids. 1—16" Side Door Elevator. 1—7" Side Door Elevator. 1—Dodge Truck and Float. 1—International L212 Truck. B. L. Rucker, P. O. Box No. 127, Telephone 1072 or 480, Mt. Vernon, Illinois.

EQUIPMENT WANTED

COUPLINGS—6" used—A.P.I. Line Pipe Couplings. State Condition, Quantity, Price. Box K-523, The Oil and Gas Journal, Tulsa, Oklahoma.

EQUIPMENT WANTED: Modern Trailer Drill, 86' mast, National T-12 or equivalent complete. Send inventory, condition, price, location, etc. Box K-562, The Oil and Gas Journal, Tulsa, Oklahoma.

WILL TRADE, 8 unit Tourist Court with 5 room living quarters and office, corner location on Main Hi-way, 3 blocks from Court House Hill County, fishing, hunting in Burnet, Texas. For complete Portable Rotary Rig with drill pipe, Franks, Joy, etc. 3500 ft. capacity or over, in top condition. Ogden B. Klein—P. O. Box 464, Taylor, Texas.

WANT TO BUY PIPE in the ground anywhere. From 6" Dia. up. Box K-572, The Oil and Gas Journal, Tulsa, Oklahoma.

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WANTED FOR foreign employment in North Africa and Middle East with independent drilling contractor, tool pushers, mud engineers, rotary and cable tool drillers, diesel mechanics, truck pushers. Must be qualified. Box K-567, The Oil and Gas Journal, Tulsa, Oklahoma.

OPERATIONS SUPERINTENDENT—Opening in medium sized natural gas utility in Midwest for an able Graduate Engineer or equivalent to supervise construction, maintenance, service on customer premises, appliance installation, metering, pressure regulation and planning system expansion. Liberal benefits. Salary commensurate with experience and ability. State personal and educational qualifications. Box K-581, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

TRANSLATORS. Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resumé to A.T.S., Inc., Drawer 271, East Orange, New Jersey.

PIPE LINE COMPANY, operating in Pennsylvania and Onio, has opening for two electrical engineers. Applicants please state experience, education and other qualifications. Box K-537, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST required by French Oil Company in Algiers. Supervise minimum of two crews plus moderate computing staff. Give qualifications and salary requirements in first letter. Box K-575, The Oil and Gas Journal, Tulsa, Oklahoma.

EVALUATION ENGINEER

Oil Company has immediate opening for graduate Engineer with a minimum of 3 years refinery experience in either operations or maintenance. Prefer experience to be along lines of estimating and appraisal. Maximum age, 35. Major can be either M.E., P.E., or Ch.E. Submit complete resume in confidence.

Box K-579,

The Oil and Gas Journal,
Tulsa, Oklahoma.

SALES MANAGER REFINERY SALES

Leading multi-plant company requires services of a salesman to head refinery sales department. Applicants must have sales experience and a working knowledge of refinery operations; a specialized knowledge of desalting, corrosion inhibitors and additives for refined products preferred. The acceptable candidate will formulate sales policies for his section and will be responsible for the development and execution of over-all marketing plans in the refining industry.

Please submit complete resumé and salary requirements to:

Box K-582,

The Oil and Gas Journal,
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IRAN OIL CO.

REQUIRES QUALIFIED AND EXPERIENCED APPLICANTS
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Petroleum Geologist
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Paleontologist
Seismologist
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for service in Iran. Salary according to qualifications.

Applicants may apply in writing, giving full details of education and previous experience and other personal details to:

P. O. Box 1516
Teheran, Iran

HELP WANTED

MANUFACTURERS Representative for proven line of engine protective equipment. Several territories open. Box K-573, The Oil and Gas Journal, Tulsa, Oklahoma.

RESERVOIR ENGINEER for Independent Oil Company, located in Houston. Must be Petroleum Engineering graduate with from 3 to 8 years experience. Salary commensurate with ability and experience. Send detailed resume of education and experience to Box K-564, The Oil and Gas Journal, Tulsa, Oklahoma.

HEAT EXCHANGER RATING ENGINEERS

Graduate engineers with 2 to 3 years of Shell-and-tube heat exchanger rating experience. Excellent opportunity with well established, growing company. Submit resume and salary requirements. All inquiries kept confidential, and interviews will be arranged.

REPLY TO E. D. ANDERSON

WESTERN SUPPLY COMPANY
P. O. Box 1888—Tulsa, Okla.

REFINERY SUPERINTENDENT

Middle East independent producer has opening for refinery superintendent with 10 to 15 years experience to supervise operation and maintenance new 30,000 BPD plant. Individual selected should be between 35-50 with ability coordinate American and foreign personnel. Resume and details should be addressed:

Box K-571,
The Oil and Gas Journal,
Tulsa, Oklahoma.

PETROLEUM ENGINEERS
FOREIGN AND DOMESTIC

Several career positions open for graduate petroleum, chemical, electrical or mechanical engineers with oil producing operations experience.

PRODUCTION & RESERVOIR:
Petroleum production, development or reservoir engineering experience; to collect, analyze and evaluate data pertaining to the characteristics and performance of oil reservoirs; to study reservoirs in order to determine the most efficient production methods and secure optimum production. Also basic reservoir research concerned with evaluation of oil production reservoirs. Assignments in Saudi Arabia and New York City.

DRILLING:
5 years in petroleum engineering work with 2 years in the drilling phase. To furnish engineering advice and assistance in the development of proven potential petroleum producing fields and improvement of the efficiency of drilling operations. Assignments in Saudi Arabia.

Excellent community facilities in Arabia. Salaries commensurate with background and experience plus all inclusive benefit plans.

Write giving full particulars regarding personal history and work experience. Please include telephone number.

Recruiting Supervisor, Box 268

ARABIAN AMERICAN OIL COMPANY
505 PARK AVENUE
NEW YORK 22, NEW YORK

HELP WANTED

EMPLOYEE RELATIONS SUPERVISOR for United States refinery of moderate size. Job involves administering of personnel policies, recruitment, and partial participation in labor relations at start with possible assumption principal duties later. Direct experience in personnel work required. Excellent opportunity in growing organization. Box K-578, The Oil and Gas Journal, Tulsa, Oklahoma.

INDEPENDENT Oil Company at Winnipeg, Manitoba, has opening for a shift foreman with 8 - 10 years' refinery experience in crude, vacuum, fluid catalytic cracking, gas recovery and cat poly unit operations. Refinery crude capacity is 12,000 barrels/day. In reply give summary of education and experience, salary expected, and date available. Write to: North Star Oil, Ltd. Box 139, St. Boniface, Manitoba. Personnel Department.

ASSISTANT DEPARTMENT MANAGER

Company located in the Mississippi Valley has an immediate opening for an Assistant Manager in its Ammonia Department. Individual should possess a BSChE Degree and have 3 to 8 years supervisory production experience, coupled with potential for promotion to Department Manager.

State education, experience, and salary history and requirement in first letter to:

Box K-525,
The Oil and Gas Journal,
Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER with B.S. in Chemical Engineering. 10 years experience as technician and director of major oil company's petroleum engineering laboratories. Cores, crude oils, waters, gases, fuel oils, condensates and bottom hole sub-surface samples. Refinery process, water flooding, dehydration and varied field experience. Box K-561, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER, 38, married, 14 years experience in drilling, production, well tests, workovers, and valuations. Now chief engineer overseas. Desire responsible position. Box K-568, The Oil and Gas Journal, Tulsa, Oklahoma.

CONSTRUCTION and Operation Chief Engineer. 35 years experience in Construction and operation of Gasoline plant. Absorbent & Refrigeration. Gas Engine Expert. Box K-574, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, Master's, fifteen years Gulf Coast, diversified exploration experience including executive. Wants position, company or independent. Box K-583, The Oil and Gas Journal, Tulsa, Oklahoma.

MAJOR COMPANY District Geologist experienced in all phases of oil exploration, Mid-Continent area. Presently employed with excellent standing record, and reference. Desires connection with Company or group engaged in foreign exploration. Fluent Spanish, some French & German. Box K-586, The Oil and Gas Journal, Tulsa, Oklahoma.

SEISMOLOGIST, PARTY CHIEF—Foreign preferred, degree, seven years experience, 4½ foreign, fluent Spanish. Box K-584, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER, age 35, ten years experience all phases pipeline industry, registered, now residing in South America, desires domestic or foreign position. Box K-580, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST: B.S. degree Petroleum Engineering; 8 yrs. well rounded seismic experience; 5 yrs. party chief and interpretation; 2 yrs. review interpretation, crew assistance and geologic coordination; experience includes steep dip and faulted areas. Can do subsurface geology. Box K-581, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

LANDMAN, 31 years of age having 8 years extensive experience in all phases of land work with one of major producing companies in Rocky Mountain Region desires to relocate in same region with Independent or aggressive Major. Box K-577, The Oil and Gas Journal, Tulsa, Oklahoma.

REAL ESTATE

INDUSTRIAL PROPERTY, Farmington, N. M., 300 Ft. by 300 Ft. improved with Shop and Office Building. Centrally located. Box K-585, The Oil and Gas Journal, Tulsa, Oklahoma.

RANCH located in colorful Santa Cruz Valley. This beautiful old Spanish Territory land provides a most entrancing atmosphere for comfortable ranch life. Over 1,000 acres of fertile valley with plenty of water, located between the Nogales Highway and the majestic Santa Rita Mountains in Southern Arizona. Owner will take home or other property in trade if located in southwestern states. Send for brochure with full details. Phone or Write to Fred H. Loveday, c/o Beal Realty, Realtor, 2917 E. Grant Road, Tucson, Ariz. Phone—EA 5-2678, EA 6-1833 Eves.

BUSINESS SERVICE

Delaware Corporation formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

PRODUCTION WANTED

WANTED: Oil properties, 100 to 5,000 barrels daily in Oklahoma and Kansas. Morris Sitrin, P. O. Box 1160, Tulsa, Okla.

FOR SALE—LIBRARY

TECHNICAL LIBRARY. Belonged to the late Dr. Byron B. Boatright, petroleum and gas consulting engineer. Inventory upon request or may be seen in Room 709, Petroleum Bldg. at Houston. Mrs. Byron Boatright, Phone HO 5-5607, or write: 11315 Smithdale Road, Houston 24.

SCOUTING

FOLLOW LAKE ERIE and adjoining inland activity; Ohio, Pennsylvania, New York. On the spot weekly report, $6.00 per month, $60.00 per year. South Shore Scouting Service, Box 355, Erie, Pa.

BUSINESS OPPORTUNITIES

FINANCIAL CONTACTS. Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817—51st St., Brooklyn, N. Y.

FOR SALE: Second hand pipe and supply business. 25 years continuous operation. Cutsinger Pipe and Tool Company, Perry, Oklahoma.

EXPERIENCED SUCCESSFUL CONSULTANT

Carbon Dioxide recovery and purification, Wax and asphalt production. Increase production, cut costs. Improve products. Have never failed—References to prove.

Box K-576, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION ENGINEERS AND GEOLOGISTS

Each and every one of you undoubtedly knows of a real "sleeper" which has been neglected to this time for some reason. On a strictly confidential basis we are willing to pay a finder's fee for information which will enable us to put some of our large cash surplus to work on worth while projects which you think are fool proof. We do not solicit "quack" ideas. If you have solid technical or business reasons for recommending a deal please send full information in confidence to

Box K-587, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

SELL YOUR GAS—Turn waste into cash. We will furnish compressors, gathering system and know-how if you have marketable gas. Knight Mfg. Co., Box 3265, Tulsa, TEmple 8-3304.

FOR SALE

Franchise permits for patented Byers Portable Prestressed Concrete Pump Jack Bases. Only three plants now in operation. Practically all territories open. Numerous orders can be provided by us to our franchised manufacturers. We retain full time field men to help obtain orders for you. Box 571.

BYERS PORTOBASE INC.,
Chanute, Kansas.

PATENTED BYERS PORTOBASE

is now a time tested and well accepted product and needs merchandising on a national scale. I would lease all rights to franchise and, or, contract the use of, my patent and trademark, with clear bill of sale at termination of lease contract, to some well qualified firm that has facilities to promote this product. I already have some inquiries about franchise permits.

LESLIE BYERS
BOX 571
CHANUTE, KANSAS
PHONE 223

FOR SALE

BYERS PORTOBASE PLANT
in
STANTON, TEXAS

Complete plant now in production making Byers patented portable prestressed concrete pump jack bases. Most operations out in open. Approximately 3 acres of land. Small building only for tools and supplies. Equipped with pretensioning bed and all necessary jacking equipment for small operation. Gross sales in 1957 over $40,000.00 on Portobases only. Potential sales practically unlimited in this area. This plant needs expanding and with proper sales promotion could be built into a large business. Located west of Stanton. Exclusive manufacturing and selling rights for patented Portobases can be contracted for on monthly basis.

BOX 571

BYERS PORTOBASE INC.,
CHANUTE, KANSAS

FOR SALE

BYERS PORTOBASE PLANT
in
OLNEY, ILLINOIS

Complete plant now in production making Byers patented portable prestressed concrete pump jack bases. 50′ x 120′ block building and most equipment new in 1956. Combined gross sales, on Portobases only in 1956 & 1957 were near $90,000.00. This plant needs additional products to keep it going in off drilling seasons and this company has no desire to manufacture anything except Portobases. Located 2 miles east of Olney on highway #50. Exclusive manufacturing and selling rights for patented Portobases can be contracted for on monthly basis.

BOX 571,

BYERS PORTOBASE INC.,
CHANUTE, KANSAS.

ROYALTIES

OFFERING CHOICE ROYALTIES with large estimated reserves per dollar invested. A. S. Berry, 520 Wright Bldg., Tulsa, Okla.

WANT PROD. Royalties, Production or Oil Co. Drill if deal is right. Eddie Fisher, 1135 W. Huntington Dr., Arcadia, Calif.

WE WANT producing royalties, producing oil & gas properties, also farmouts gas acreage. Ben H. Williams — Clarendon, Texas.

HAVE EXCELLENT market for producing royalty. Prefer a developed or partially developed field. R. E. Clement, Box 65, Norman, Oklahoma.

LEASE AND DRILLING BLOCKS

FOR SALE BY OWNER working interest and operational management in leases and 19 wells producing from 2500 foot zone; also interests in other properties. Box K-541, The Oil and Gas Journal, Tulsa, Oklahoma.

OIL AND GAS MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

NORTHWEST ARKANSAS Oil Gas Mineral leases. Fee owner 1,800 acres Western Newton County. 360 Acres Southern Madison County. C. C. Hall, N. T. Station, Denton, Texas.

DEVELOPED Primary Producing Properties are needed by principals. Submit production history, location, and asking price for quicker evaluation. Preference for properties in Kansas, Oklahoma, Texas, Illinois or Arkansas. Graybol Oil Corporation, NBT Building, Tulsa, Oklahoma.

SPECULATIVE Oil Opportunity. Want associates in drilling wells in Osage County. Several possible pay sands. Excellent chance for production. Small investment. J. H. Gwin, 1027 Cravens Building, Oklahoma City, Phone JA 4-9850.

NOTICE OF SALE BY TRUSTEE IN DISSOLUTION OF CORPORATION OF PRODUCING ROYALTY INTERESTS IN CADDO COUNTY, OKLAHOMA.

NOTICE IS HEREBY GIVEN that on the 4th day of April, 1958, at the hour of 2:00 o'clock P.M., in the foyer of the Court House in the City of Alva, Woods County, Oklahoma, the undersigned will sell to the highest and best bidder for cash, subject to confirmation of the District Court of Woods County, Oklahoma, all of the right, title and interest of the Enid Drilling Company, dissolved, in and to the following mineral interests under the real estate described, which are now producing oil:

1. An Undivided 4/40ths mineral interest in and under the Northwest Quarter ($SW\frac{1}{4}$) of the Southwest Quarter ($SW\frac{1}{4}$) of Section Four (4), Township Five (5) North, Range Nine (9), W.I.M., Caddo County, Oklahoma.
2. An undivided 4/100ths mineral interest in and under the west Half ($W\frac{1}{2}$) of the Southeast Quarter ($SE\frac{1}{4}$), and the West Half ($W\frac{1}{2}$) of the Southeast Quarter ($SE\frac{1}{4}$) of the Southeast Quarter ($SE\frac{1}{4}$), of Section Four (4), Township Five (5) North, Range Nine (9), W.I.M., Caddo County, Oklahoma.

The foregoing interests were adjudicated as being owned by said corporation by judgment in the case of W. L. Thatcher vs. Matie B. Glasgow, et al., No. 16,828, District Court of Caddo County, Oklahoma, on March 12th, 1954, and sale of such mineral interests is being made by the undersigned Trustee pursuant to Order of the District Court of Woods County, Oklahoma, entered January 15th, 1958, in The Matter of the Dissolution of the Enid Drilling Company, a Corporation, No. 10,748.

DATED February 19th, 1958.

JOHN B. DOOLIN, TRUSTEE

Office: Alva State Bank Building
Alva, Oklahoma.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Denver, Colorado. Notice is hereby given that 3,443.52 acres of land in seven parcels within the known geologic structure of South McCallum Field in Jackson County, Colorado, will be offered for oil and gas leasing through competitive bidding to the qualified bidder of the highest cash amount per acre, at 2 p.m., M.S.T., April 8, 1958, when bids will be opened. Details of the lease offering, how and where to submit bids, and forms, may be obtained from the Bureau's Land Office, P. O. Box 1018, Denver, Colorado. John L. Rankin, Manager.

ADVERTISERS
in this issue

ACF Industries, Incorporated, Valve Division 10
Alco Products, Inc. 196, 197
Aldrich Pump Cmpany, The 12
Allis-Chalmers Mfg. Co. 25
Alten Foundry & Machine Works, Inc. 210
American Cable Division of American Chain & Cable 16
American Iron & Machine Works Co. 31
Armstrong Machine Works 174

Baash-Ross Tool Company 208
Baker Oil Tools, Inc. 58, 188, 189
Bank of the Southwest 206
Baroid Division, National Lead Co. 46, 47
Beacon Petroleum Company 134
Bethlehem Steel Co. 127
Black, Sivalls & Bryson, Inc. 50
Bovaird Supply Co., The 1
Bower Roller Bearing Company 14
Brewster Company, Inc., The 37, 38
Brown Oil Tools, Inc. 51
Business Reports, Inc. 187

Cable Engineering 216
Chain Belt Co. 36
Chevrolet Motor Div., General Motors Corp. 176, 177
Classified Advertising 229, 230, 231, 232
Coates Field Service, Inc. 171
Colorado Fuel and Iron Corp. 41
Continental Electric Motors 134
Continental-Emsco Company 20, 21
Coppus Engineering Corp. 5
Corrosion Services Incorporated 178
Crane Co. 103
Crose Manufacturing Co., Inc., M. J. 172

Davison Chemical Company Division of W. R. Grace & Co. 131
Denison Engineering Division American Brake Shoe Co. 205
Detroit Diesel Engine Division, General Motors Corp. 18
Dowell Incorporated— 168, Inside Back Cover
Drilling & Service, Inc. 191

Elgen Corporation, The 209
Elliott Company 11
Engineering Controls, Inc. 48

Fairbanks, Morse & Co. 4
Fleet-Line Co. 171
Fluor Corporation, Ltd., The 79
Ford Motor Company— 141 through 164, 166, 174
Foxboro Company, The 23

Gates Rubber Co., The 186
General Geophysical Company 13
General Welding Works 214
Geophysical Service, Inc. 200
Goodrich Chemical Company, B. F. (Hycar) 7
Goodyear Tire & Rubber Company, The 17
Gorman-Rupp Company, The 29
Grancell, I. H. 185
Guiberson Corporation 40
Gulf Oil Corporation 124
Gustin-Bacon Manufacturing Co. 54

Halliburton Oil Well Cementing Co.— Inside Front Cover, 8, 9, 193
Harrisburg Steel Co. 187
Hercules Tool Company 216
Hudson Engineering Corporation 121
Huey & Co., S. E. 171
Hughes Tool Co. Back Cover
Hyatt Bearings Division, General Motors Corp. 26

International Harvester Co. 15, 107, 136, 137
International Nickel Company, Inc., The 218

Johnston Testers, Inc. 42, 43
Jones Company, The S. M. 108, 109

Kemp Mfg. Co., C. M. 220

Larkin Packer Company, Inc. 49
Lone Star Cement Corporation 62
Lukens Steel Company 60, 61
Lummus Company, The 83

M & V Tank Co. 214
Magnet Cove Barium Corp. 55
Manning, Maxwell & Moore, Inc. 181
Massey-Ferguson Industrial Division Massey-Harris-Ferguson, Inc. 22
Master Tank & Welding 194
McDonough Marine Service 185
Mission Mfg. Company 182, 183
Mixing Equipment Co., Inc. 138

National Aluminate Corp. 105
National Tank Company 234
Naugatuck Chemical Division of United States Rubber Company 32, 33

Ohio Injector Company 27
Oil Center Tool Co. 39
Oil Well Supply Division 6
Orbit Valve Company 112
Otis Engineering Corporation 53

Pfizer & Co., Inc., Chas. 24
Philco Corporation 170

Reed Roller Bit Company 122, 123
Refinery Supply Co., The 134
Rockford Clutch Division of Borg-Warner Company 213
Roebling's Sons Company, John A. 184

Salt Water Control, Inc. 223
Schlumberger Well Surveying Corp. 217
Sikorsky Aircraft 119
Smithco Engineering, Inc. 45
Spencer-Safford Loadcraft, Inc. 111
Standard Oil Co. of California 56
Standard Oil Company (New Jersey) 114
Stewart & Stevenson Services, Inc. 128, 129

Taylor Forge & Pipe Works 116, 117
Texas Employers Insurance Association 30
Thornhill-Craver Co. 52
Timken Roller Bearing Company 35
Tretolite Company A Division of Petrolite Corporation 19
Tulsa Winch Division of Vickers, Inc 173

Union Carbide Chemicals Company Div. of Union Carbide Corporation 28
United States Borax & Chemical Corporation, Pacific Coast Borax Company Division 44
United States Rubber Company, Naugatuck Chemical Division 32, 33
United States Steel Corporation— Oil Well Supply Division 6

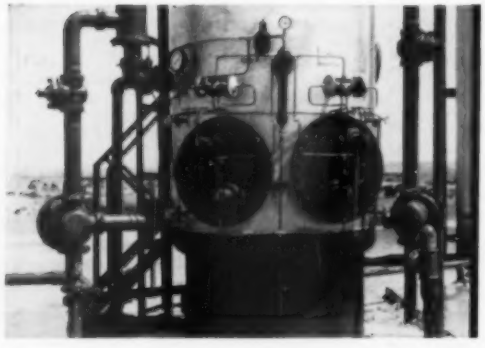
Viking Pump Co. 180

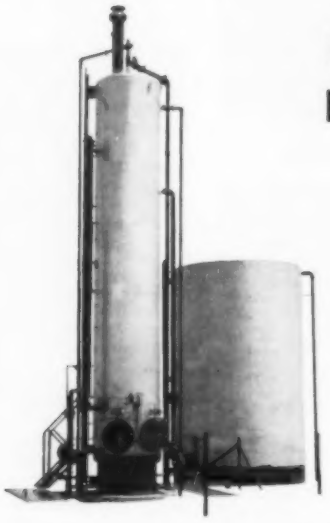
Weatherford Oil Tool Co., Inc. 132
Well Equipment Mfg. Corp. 34
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries Incorporated 10

Youngstown Sheet and Tube Company 75

Zink Company, John 211

NATIONAL'S *metering treater*





COMBINES EFFICIENT EMULSION TREATING WITH AUTOMATIC METERING AND RECORDING

Now! . . . the incomparable National emulsion treater is equipped with metering compartments to automatically meter and record the volume of water and oil being produced. Combining the metering vessels for both oil and water into a lower compartment of a National treater offers distinct advantages over adding metering vessels to the lease equipment at some other time.

NATIONAL'S METERING TREATER —

- Provides more uniform temperature of metered liquid during periods of wide variation in ambient temperature.
- Lessens paraffin deposition on wall of metering chamber by virtue of higher average temperature of oil.
- Provides measurement of clean oil and oil-free water.
- Reduces amount of solution gas in oil and thus reduces shrinkage due to flashing of oil to storage pressure.
- With "Full Area" construction of meter chambers, provides uniform fill and discharge rates over a complete cycle.
- Groups controls and working parts of metering chambers for easy accessibility or housing.
- Reduces installation time and fittings required for connecting components.
- Reduces size of foundation requirements or platform space.
- Reduces maintenance costs over multiple vessel installation.
- Allows accurate testing of wells individually without additional tank capacity.

Patent Applied for

It's a National®

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

MISSISSIPPIAN CHERT

Kay County, Oklahoma

Responds well to Sandfrac*. Typical treatment: 750 gals. refined oil per foot of pay, and 1½-2 lbs. sand per gal. Injection rate: 30 BPM. Petrojel* successful but use limited by lease crude storage cost. Excellent results with Riverfrac*, but water shortage limits its use here.

YATES

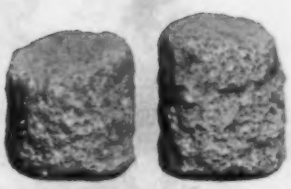
West Texas — New Mexico

In certain areas, such as Shafter Lake Field, Andrews County, Texas, Riverfrac has been successful in many wells after all other treatments had failed. Typical treatment this field: 35,000-40,000 gals. fresh water, 20,000 lbs. sand. Injection rate: above 25 BPM recommended.

"D" SAND

Denver — Julesburg, Colorado

BHT frequently exceeds 225° F. Sandfrac, using refined oil, preceded by Mud Acid, generally used. Results vary widely, depending on degree of depletion. Typical treatment: 400 gals. Mud Acid, 10,000 gals. oil, 10,000 lbs. sand. Injection rates: 5-10 BPM through tubing, 10-20 BPM through casing.

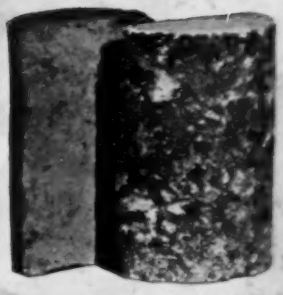


LOWER FRIO

South Texas

Treatment of tight intervals depends mainly on depth and bottom hole temperature. Petrofrac* recommended for shallow wells with BHT under 150° F; Petrojel where BHT range is 150° F—180° F. In deep, high BHT wells, Stratafrac* or Acid Petrofrac* gives excellent results.

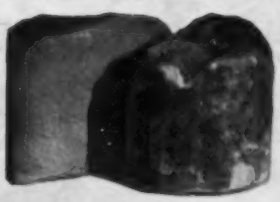
Dowell guide to fracturing



MISSISSIPPIAN CHAT

Barber County, Kansas

This formation, although only slightly soluble in acid, responds well to Acid Petrofrac. Typical treatment: 1,000 gals. fluid and 1,000 lbs. sand per foot of perforation. Injection rate: 30 BPM. Results on gas wells generally ten times drill stem test.



TENSLEEP

Big Horn Basin, Wyoming

Tight Pennsylvanian Sandstone, usually requiring high injection pressures. Normal treatment is down tubing. Widely varying depths and BHT. Petrojel successful in shallower sections where BHT is under 180° F; Sandfrac, using refined oil, preferred in deeper wells with higher BHT.

CARDIUM CONGLOMERATE AND SAND

Pembina Field, Alberta

Conglomerate interval normally prolific without stimulation. Sand usually requires fracturing. Sandfrac, preceded by Mud Acid, gets good results. Typical treatment: 500 gals. Mud Acid followed by 20,000-30,000 gals. lease crude with 40,000 lbs. sand. Injection rate: 20-30 BPM.

These cases give general information about treatments which have been successful in the formations shown. However, each well has its own unique characteristics which require the attention of experts. Dowell engineers have gathered performance data from fracturing operations in most active fields in the United States and Canada. Chances are that they already have the answer to your particular treating problem. If not, the Dowell laboratory and engineering staff is at your service. Dowell Incorporated, Tulsa 1, Oklahoma.

Services for the oil industry

DOWELL

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Pioneered and perfected by Hughes—Tri-Cone rock bits set the standard of performance the world over. Back of each Hughes bit is the industry's greatest rock bit experience . . . plus a half century of laboratory and field research. Wherever you drill, Hughes bits—either regular or jet—are available in the sizes and types best suited to your particular drilling requirements. And of this you can be sure—the Hughes bits you get will incorporate the very latest in rock bit improvements!

HUGHES TOOL COMPANY

* R SERIES BITS CUT DOWN THOSE COSTLY ROUND TRIPS. THE RG-1—SHOWN HERE WITH FORTIFIED GAGE—IS RECOMMENDED WHEN GAGE WEAR IS A PROBLEM IN EXTREMELY HARD ABRASIVE FORMATIONS